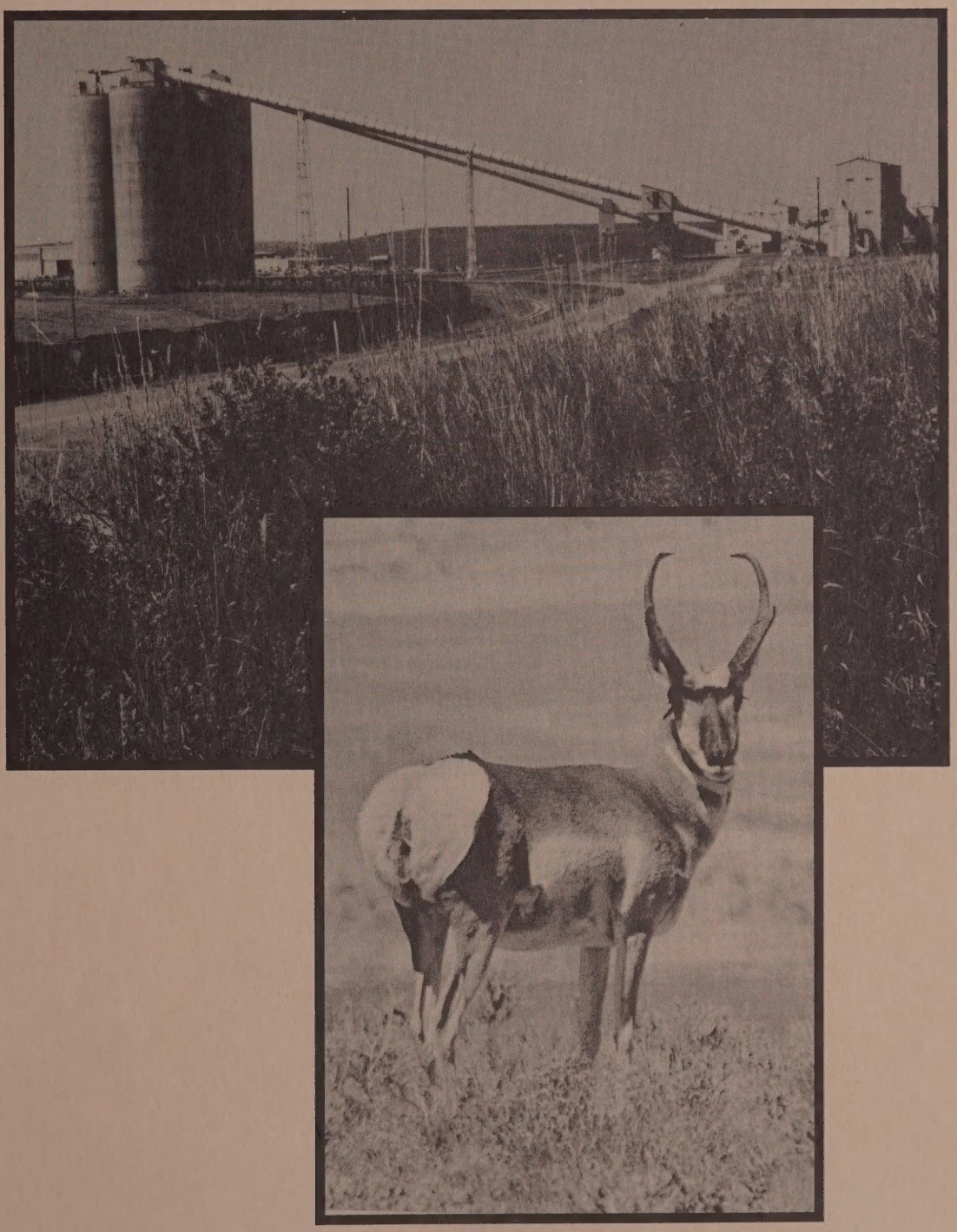
BLM LIBRARY
88081472

U.S. Department of the Interior
Bureau of Land Management
Wyoming State Office

Casper District Office

January 1992

Draft
West Rocky Butte Coal Lease Application Environmental Impact Statement



TD
195
.C58
W479
1992

The Bureau of Land Management is responsible for the balanced management of the public lands and resources and their various values so that they are considered in a combination that will best serve the needs of the American people. Management is based upon the principles of multiple use and sustained yield; a combination of uses that take into account the long term needs of future generations for renewable and nonrenewable resources. These resources include recreation, range, timber, minerals, watershed, fish and wildlife, wilderness and natural, scenic, scientific and cultural values.

DES-92-1

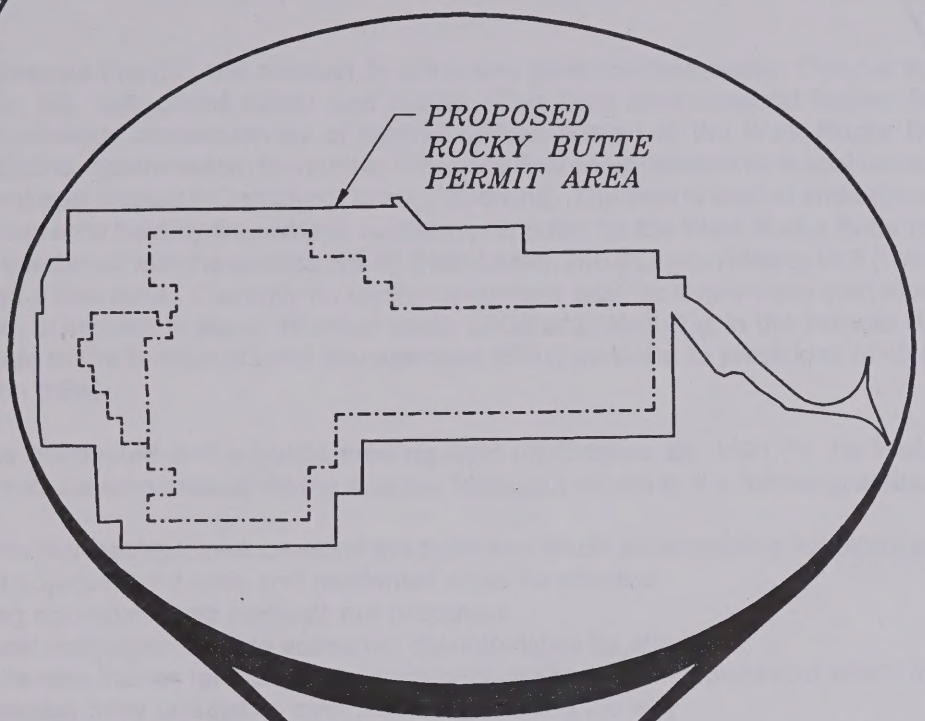
#26677726
ID: 88081472
TD
195
.C58
W479
1992

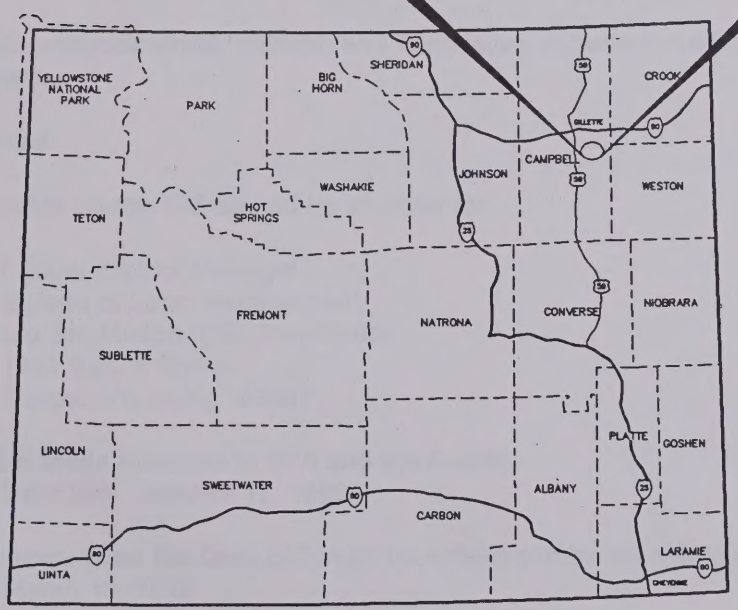
U.S. Department of the Interior
Bureau of Land Management

Wyoming

January 1992

Draft Environmental Impact Statement West Rocky Butte Coal Lease Application DES-92-1





THE STATE OF WYOMING

BLM Library
Denver Federal Center
Bldg. 85, OC-521
P.O. Box 25047
Denver, CO 80225

U.S. Department of the Interior
Bureau of Land Management

Wyoming January 1992

Draft Environmental Impact Statement West Rocky Butte Coal Lease Application

DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE WEST ROCKY BUTTE COAL LEASE APPLICATION

(X) Draft ( ) Final

U.S. Department of the Interior
Bureau of Land Management

Abstract

Notice of Intent to prepare this EIS and conduct Scoping was given on Wednesday, October 9, 1991 in Federal Register Volume 56, No. 196, pages 50921 and 50922. This Draft Environmental Impact Statement (DEIS) assesses the environmental consequences of leasing options related to the West Rocky Butte Coal Lease Application WYW 122586. Northwestern Resources Company filed an application for a coal lease (the West Rocky Butte tract) on federal coal located in Campbell County, Wyoming. The tract is west of and adjacent to an existing lease WYW 78633 currently held by the subject company. In order for the West Rocky Butte tract to be mined, it would have to be combined with the existing Rocky Butte Lease, into a Logical Mining Unit (LMU), and the entire area be permitted as a new mine. Currently no mining operations exist, so a new mine start would be necessary to begin production. The area is about 10 miles south of Gillette, Wyoming in the Powder River Basin. This application was made to the Bureau of Land Management (BLM) pursuant to provisions of 43 CFR 3425.1 as a Lease-by-Application (LBA).

Public scoping was conducted and a public meeting held on October 22, 1991, in the Holiday Inn, Gillette, Wyoming. Issues and concerns raised during scoping focused analysis in the following areas:

How will potential leasing/development of the combined tracts affect existing Air, Noise and Water Quality
How would adjacent land uses and residential areas be affected
What mining operations and methods are proposed
How will local and regional socio-economic characteristics be affected
What are the time frames for leasing/environmental analysis/development and which federal and state agencies have jurisdiction over which steps along the way

This DEIS analyzes direct, indirect, and cumulative impacts to various resources from the leasing options and alternatives.

EIS Contact:

Comments on this EIS should be directed to:

Casper District Manager
Bureau of Land Management
c/o Jim Melton, EIS Coordinator
1701 East E Street
Casper, Wyoming 82601

Date DEIS Made Available to EPA and the Public:
Draft EIS: January 17, 1992

Date Comments on the Draft EIS must be received to be considered in the Final EIS:
March 16, 1992

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Wyoming State Office
P.O. Box 1828
Cheyenne, Wyoming 82003

TAKE PRIDE IN AMERICA

3420
WYW122586

Dear Reader:

This Draft Environmental Impact Statement (DEIS) is prepared pursuant to 40 CFR 1500-1508, for the West Rocky Butte Coal Lease Application (WYW122586) in the Powder River Basin, Wyoming. The DEIS is provided for your review and comment and the Final Environmental Impact Statement (FEIS) will be based on comments received on this draft. Please keep this copy of the draft EIS for future use to your review of the final EIS.

The public comment period of this draft EIS is from January 17, 1992 through March 16, 1992. When making written comments(s) please be as specific as possible and identify the specific Chapter, page and paragraph the comment(s) pertain to. The purpose of the review and comment is to provide you an opportunity to participate in the environmental analysis process and ultimate decisions reached.

A public hearing is currently scheduled for the West Rocky Butte Application/DEIS at the Holiday Inn, 2009 South Douglas Highway, Gillette, Wyoming, on Wednesday, February 26, 1992, at 7 p.m. In addition, an informal open house will be held from 3 to 5 p.m. that afternoon at the Holiday Inn to answer any questions you may have regarding the West Rocky Butte coal lease application and environmental analysis process. Should a change in scheduling occur, you will be notified.

Please address comments on this draft EIS and request for additional copies of the draft EIS to:

Casper District Office
Bureau of Land Management
c/o Jim Melton, EIS Coordinator
1701 East "E" Street
Casper, WY 82601

Sincerely,

Ray Brubaker

Ray Brubaker
State Director

Draft
Environmental Impact Statement
for the
West Rocky Butte Coal Lease Application
(Federal Coal Lease Application WYW122586)
DES-92-1

Prepared by

Western Water Consultants, Inc.
Mariah Associates, Inc.
Browne, Bortz & Coddington, Inc.

For the

Casper District Office
Bureau of Land Management

Cooperating Agency:
Office of Surface Mining

January 1992

CONTENTS

EXECUTIVE SUMMARY Exec-1

1.0 INTRODUCTION 1-1
- 1.1 General Location 1-1
- 1.2 Purpose and Need for Action 1-1
- 1.3 Authorizing Actions 1-1
- 1.4 Relationship to Powder River Basin Coal Demand Forecasts 1-4
- 1.5 Relationship to BLM Policies, Plans and Programs 1-5
- 1.6 Additional Permit Requirements 1-6

2.0 PROPOSED ACTION AND ALTERNATIVES 2-1
- 2.1 Introduction 2-1
- 2.2 Description of Proposed Action 2-1
- 2.3 No Action Alternative 2-6
- 2.4 Alternatives Considered But Not Analyzed in Detail 2-9
- 2.5 Comparison of Alternatives 2-9

3.0 AFFECTED ENVIRONMENT 3-1
- 3.1 Geology and Mineral Resources 3-1
- 3.2 Topography 3-1
- 3.3 Soils 3-3
- 3.4 Vegetation 3-4
- 3.5 Water Resources 3-6
  - 3.5.1 Surface Water 3-6
  - 3.5.2 Ground Water 3-8
- 3.6 Alluvial Valley Floors 3-12
- 3.7 Fish and Wildlife 3-13
  - 3.7.1 Fisheries 3-13
  - 3.7.2 Big Game Animals 3-13
  - 3.7.3 Raptors 3-16
  - 3.7.4 Upland Game Birds 3-17
  - 3.7.5 Migratory Birds of High Federal Interest 3-17
  - 3.7.6 Threatened and Endangered Species 3-17
  - 3.7.7 Other Species 3-20
- 3.8 Historical, Archaeological, and Paleontological Resources 3-20
  - 3.8.1 Archaeological Resources 3-20
  - 3.8.2 Historical Resources 3-24
  - 3.8.3 Paleontological Resources 3-25
- 3.9 Recreation 3-25
- 3.10 Climate and Air Quality 3-26
  - 3.10.1 Climate 3-26
  - 3.10.2 Air Quality 3-27
- 3.11 Visual Resources 3-29
- 3.12 Noise 3-31

CONTENTS

3.13 Transportation Facilities 3-33
3.13.1 Railroads 3-33
3.13.2 Roads 3-33
3.13.3 Airlines 3-34
3.14 Land Use and Ownership 3-34
3.14.1 Land Ownership 3-34
3.14.2 Land Use 3-34
3.15 Socioeconomics 3-38
3.15.1 Demographic Characteristics 3-38
3.15.2 Economic Characteristics 3-41
3.15.3 Overview of Infrastructure and Public Sector Fiscal Conditions . . . 3-45

4.0 ANALYSIS OF PROPOSED ACTION AND ALTERNATIVES . . 4-1
4.1 Environmental Impacts of the Proposed Action 4-4
4.1.1 Geology and Mineral Resources 4-4
4.1.2 Topography 4-5
4.1.3 Soils 4-5
4.1.4 Vegetation 4-8
4.1.5 Water Resources 4-9
4.1.6 Alluvial Valley Floors 4-15
4.1.7 Fish and Wildlife 4-16
4.1.8 Historical, Archaeological, and Paleontological Resources 4-18
4.1.9 Recreation 4-19
4.1.10 Air Quality 4-19
4.1.11 Visual Resources 4-21
4.1.12 Noise 4-21
4.1.13 Transportation Facilities 4-22
4.1.14 Land Use and Ownership 4-23
4.1.15 Socioeconomics 4-25
4.2 Analysis of the No Action and Alternatives 4-33
4.2.1 Geology and Mineral Resources 4-33
4.2.2 Topography 4-33
4.2.3 Soils 4-33
4.2.4 Vegetation 4-33
4.2.5 Water Resources 4-33
4.2.6 Alluvial Valley Floors 4-34
4.2.7 Fish and Wildlife 4-34
4.2.8 Historical, Archaeological and Paleontological Resources 4-34
4.2.9 Recreation 4-34
4.2.10 Air Quality 4-34
4.2.11 Visual Resources 4-34
4.2.12 Noise 4-34
4.2.13 Transportation Facilities 4-34
4.2.14 Land Use and Ownership 4-34
4.2.15 Socioeconomics 4-34

5.0 MITIGATION 5-1

CONTENTS

6.0 CUMULATIVE IMPACTS 6-1
6.1 Actual and Predicted Coal Activity in the Eastern Powder River Region 6-1
6.2 Actual and Predicted Coal Activity in Campbell County 6-4
6.3 Geology and Mineral Resources 6-7
6.4 Topography 6-7
6.5 Soils 6-7
6.6 Vegetation 6-7
6.7 Water Resources 6-9
6.7.1 Ground Water 6-9
6.7.2 Surface Water 6-14
6.8 Alluvial Valley Floors 6-15
6.9 Fish and Wildlife 6-15
6.10 Historical, Archaeological and Paleontological Resources 6-16
6.11 Recreation 6-16
6.12 Air Quality 6-17
6.13 Visual Resources 6-17
6.14 Noise 6-17
6.15 Transportation Facilities 6-17
6.16 Land Use and Ownership 6-17
6.17 Socioeconomics 6-19
6.17.1 Baseline Socioeconomic Projections 6-20
6.17.2 Mineral and Energy-Related Developments 6-20
6.17.3 Baseline Employment Projections 6-20
6.17.4 Baseline Household and Population Projections 6-21
6.17.5 Cumulative Employment and Population Projections 6-21
6.17.6 Cumulative Economic Impacts 6-23
6.17.7 Cumulative Infrastructure and Public Sector Financial Impacts . . . 6-24
6.17.8 Public Safety 6-24
6.17.9 Health Facilities and Services 6-24
6.17.10 Educational Facilities 6-25
6.17.11 Public Sector Fiscal Conditions 6-25
6.17.12 Cumulative Impacts on Social Well-Being 6-25

7.0 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES AND SHORT-TERM USE OF ENVIRONMENT VS LONG-TERM PRODUCTIVITY 7-1
7.1 Irreversible and Irretrievable Commitment of Resources 7-1
7.2 Short-Term Use of the Environment vs. Long-Term Productivity . . . 7-2

8.0 CONSULTATION AND COORDINATION 8-1
8.1 Team Organization 8-1
8.2 Consultation and Coordination 8-1
8.3 Coordination in the Review of the Draft EIS 8-2
8.4 Where Copies Can Be Inspected 8-7

CONTENTS

REFERENCES Ref-1

APPENDIX A. VALIDATION OF UNSUITABILITY CRITERIA FOR WEST ROCKY BUTTE TRACT A-1

APPENDIX B. RECLAMATION PLAN B-1

APPENDIX C. VISUAL RESOURCE MANAGEMENT EVALUATION . C-1

APPENDIX D. MITIGATION D-1

LIST OF TABLES

Table 2-1.	Life-of-Mine Mass Balance for Rocky Butte Mine	2-3
Table 2-2.	Rocky Butte Mine Equipment Requirements	2-5
Table 2-3.	Predicted Life-of-Mine Employment Requirements for Rocky Butte Mine	2-8
Table 3-1.	Acres of Topsoil for Reclamation Within the Proposed Permit Area and Disturbed Area	3-3
Table 3-2.	Acreage of Vegetation Types Within the Proposed Disturbed Area and the Rocky Butte Permit Area, Campbell County, Wyoming	3-4
Table 3-3.	Migratory Birds of High Federal Interest in Northeast Wyoming and Expected Occurrence On or Near the Proposed Rocky Butte Mine, Campbell County, Wyoming, 1991	3-19
Table 3-4.	Cultural Resource Inventories in Rocky Butte Area	3-21
Table 3-5.	Rocky Butte Archaeological Inventory	3-22
Table 3-6.	Hunter Survey for Hunt Areas 21 and 24 (Campbell County, Wyoming): Mule Deer, White-Tailed Deer and Antelope, 1990	3-26
Table 3-7.	Regulated Air Emissions for Wyoming	3-28
Table 3-8.	Maximum Allowable Increases for Prevention of Significant Deterioration of Air Quality in Wyoming	3-28
Table 3-9.	Summary of Air Quality Monitoring in Wyoming's Powder River Basin, 1980-1988	3-29
Table 3-10.	Typical Noise Levels of Common Occurrence	3-33

CONTENTS

Table 3-11.	Oil Production Within the Rocky Butte Study Area	3-37
Table 3-12.	Crop and Forage Production, Campbell County, Wyoming	3-37
Table 3-13.	Acreage of Land Use Types in Disturbed and Proposed Permit Area, Rocky Butte Area, Campbell County, Wyoming	3-38
Table 3-14.	Population Change for Campbell County and Wyoming, 1980-1990	3-39
Table 3-15.	Households and Household Size, City of Gillette and Campbell County, 1980 and 1990	3-40
Table 3-16.	Age Distribution, 1990	3-40
Table 3-17.	Educational Attainment Levels: Percent of Population 25 Years Old and Over	3-40
Table 3-18.	Workers Per Household, Campbell County	3-41
Table 3-19.	Employment Summary, Campbell County, 1985-1990, Annual Average	3-41
Table 3-20.	Campbell County Employment by Industry, 1985 and 1989	3-42
Table 3-21.	Major Employers in Campbell County, 1991	3-42
Table 3-22.	Personal Income by Industry, Campbell County, 1981, 1985 and 1989	3-43
Table 3-23.	Cost of Living, City of Gillette, 1989-1991	3-43
Table 3-24.	City of Gillette Housing Stock, 1987-1990	3-44
Table 3-25.	Retail Activity, Campbell County, 1985-1990	3-45
Table 3-26.	Campbell County School District Enrollment	3-47
Table 3-27.	Campbell County Budget Summary, 1991-92 Fiscal Year	3-48
Table 3-28.	City of Gillette, General Fund, 1990	3-48
Table 3-29.	Distribution of Sales and Use Tax Within Campbell County, 1987-1990	3-49
Table 3-30.	Campbell County Assessed Value, 1988-1990	3-49
Table 3-31.	Taxes Levied, Campbell County, 1988-1990	3-49
Table 3-32.	Assessed Valuation and Taxes Levied, Gillette, 1988-1990	3-50
Table 4-1.	Summary of Impact Analysis for the Proposed Action and No Action Alternatives	4-2
Table 4-2.	Acreage of Life of Mine Disturbance Within Wildlife Habitats on the Proposed Rocky Butte Mine, Campbell County, Wyoming, 1991	4-17

CONTENTS

Table 4-3.	Areas of Projected Disturbance of Land Use Types Within Campbell County, the Rocky Butte Permit Area, and Within the Total Permitted Acreage of All Mines in Campbell County, Wyoming	4-24
Table 4-4.	Estimated Reduction in Agriculture Productivity Due to Mining in Campbell County, and in the Rocky Butte Project Area	4-25
Table 4-5.	Settlement Patterns of Nearby Projects	4-26
Table 4-6.	Projected Rocky Butte Commuting Patterns	4-27
Table 4-7.	Estimated Wages and Salaries for the Rocky Butte Mine, Millions of 1991 Dollars	4-28
Table 4-8.	Total Earnings Attributable to the Rocky Butte Mine, Excluding Benefits, Millions of 1991 Dollars	4-29
Table 4-9.	Total Campbell County Retail and Service Trade Attributable to the Rocky Butte Mine, Millions of 1991 Dollars	4-30
Table 4-10.	Projected Households and Population Directly and Indirectly Attributable to the Rocky Butte Mine	4-30
Table 4-11.	Selected Federal Revenues Generated Directly from the Rocky Butte Mine	4-32
Table 6-1.	Mine Sites Addressed in Prior Regional Coal Development EIS's	6-2
Table 6-2.	Cumulative Regional Activity, Eastern Powder River Coal Region (Campbell and Converse Counties, Wyoming)	6-3
Table 6-3.	Cumulative Surface Disturbance, Employment and Population -- Actual and Predictions -- Without the Lease-By-Applications, Eastern Powder River Coal Region (Campbell and Converse Counties)	6-4
Table 6-4.	Comparison Between 1990 Campbell County Coal Production by Mine as Predicted in 1981 Regional EIS and As Actually Occurred	6-5
Table 6-5.	Comparison Between Rocky Butte Mine Proposal as Assumed for 1981 Regional EIS and as Proposed by NWR	6-6
Table 6-6.	Total Acres and Percentages of Projected and Actual Disturbance of Vegetation Types Within the Eastern Powder River Basin (EPRB), the Rocky Butte Permit Area, and Within the Total Permitted Acreage of All Mines in the EPRB, Converse and Campbell Counties, Wyoming	6-8
Table 6-7.	Areas and Percentages of Projected Disturbance of Vegetation Types Within the EPRB, Rocky Butte Project Area, and Within the Total Permitted Acreage of All Mines in the EPRB, Campbell and Converse Counties, Wyoming	6-9
Table 6-8.	Cumulative Wildlife Impacts from Surface Mining in the EPRB,	

	Wyoming, 1991	6-15
Table 6-9.	Particulate Concentration by Mine in the Eastern Powder River as Projected for 1990 and as Measured for 1990 for the Annual Ambient Air Quality Standard	6-18
Table 6-10.	Particulate Emissions by Mine in the Eastern Powder River Basin as Projected for 1990 and as Estimated from Actual Mining Activities in 1990	6-19
Table 6-11.	Projected Baseline Labor Force and Employment, Campbell County	6-21
Table 6-12.	Projected Baseline Population, Campbell County and City of Gillette	6-22
Table 6-13.	Cumulative Employment Impacts, Campbell County	6-22
Table 6-14.	Cumulative Population Impacts, Campbell County and City of Gillette	6-23
Table 6-15.	Campbell County School District Enrollment	6-26

LIST OF FIGURES

Figure 1-1.	General Location Map for the West Rocky Butte LBA Area	1-2
Figure 1-2.	Location Map of Rocky Butte Tract, West Rocky Butte LBA Tract and Proposed LMU Permit Area	1-3
Figure 2-1.	Rocky Butte Mine Layout and Pit Progression	2-2
Figure 2-2.	Locations of Coal Mines and Transportation Facilities in Campbell County, Wyoming	2-7
Figure 3-1.	Generalized Geologic Cross Section in Proposed Rocky Butte Mine Area	3-2
Figure 3-2.	Vegetation Types On and Near the Rocky Butte Mine Area	3-5
Figure 3-3.	Surface Water Features in Vicinity of Proposed Rocky Butte Mine	3-7
Figure 3-4.	Regional Premining Static Water Levels in the Wasatch Overburden	3-9
Figure 3-5.	Regional Premining Static Water Levels in the Wyodak-Anderson Coal Seam	3-10
Figure 3-6.	Pronghorn Antelope Ranges On and Near the Proposed Rocky Butte Mine	3-14
Figure 3-7.	Deer Range On and Near the Proposed Rocky Butte Mine	3-15
Figure 3-8.	Raptor Nests and Sage Grouse Leks On and Near the Proposed Rocky Butte Mine	3-18

CONTENTS

Figure 3-9.	Wind Rose for Proposed Rocky Butte Mine Area	3-27
Figure 3-10.	Visual Resource Management Classification and Visual Survey Area for Proposed Rocky Butte Mine	3-30
Figure 3-11.	Locations of Residences Potentially Subject to Noise Impact and Transportation Facilities in Vicinity of Proposed Rocky Butte Mine	3-32
Figure 3-12.	Surface Ownership On and Near the Proposed Rocky Butte Mine	3-35
Figure 3-13.	Mineral Ownership On and Near the Proposed Rocky Butte Mine	3-36
Figure 4-1.	Premining 3-Dimensional Perspective View of Rocky Butte Mine Area	4-6
Figure 4-2.	Postmining 3-Dimensional Perspective View of Rocky Butte Mine Area	4-7
Figure 4-3.	Predicted Drawdowns vs. Actual Drawdowns in the Wyodak-Anderson Coal at the End of 1990	4-12
Figure 4-4.	Model-Predicted Maximum Extent of Drawdown in Coal and Overburden Without Rocky Butte Mine	4-13
Figure 4-5.	Model-Predicted Maximum Extent of Drawdowns in Coal and Overburden With Rocky Butte Mine	4-14
Figure 4-6.	Isoconcentration Lines of PM_{10} Emissions Generated from Planned Rocky Butte Mine Operations in Year 2001	4-20
Figure 6-1.	Comparison Between the 1990 Cumulative Drawdowns and the Mines Worst-Case and the USGS Predicted Drawdowns (Modified from Hydro-Engineering, 1991)	6-12

ABBREVIATIONS AND ACRONYMS

AIRFA	American Indian Religion Freedom Act
AOC	approximate original contour
AQD	Air Quality Division, Wyoming DEQ
ARPA	Archeologicoal Resources Protection Act
AUM	animal unit month
AVF	alluvial valley floor
BBC	Browne, Bortz & Coddington, Inc.
bcy	bank cubic yard
BLM	Bureau of Land Management, U.S. Department of the Interior
BNR	Burlington Northern Railroad
Btu	British thermal unit
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations. Numbers refer to title and part; that is, 43 CFR 4100 refers to title 43, part 4100.
cfsm	cubic feet per second per square mile
CHIA	cumulative hydrologic impact assessment
CNR	Chicago and Northwestern Railroad
db	Decibel(s)
dBA	"A" weighted decibel(s)
DEQ	Wyoming Department of Environmental Quality
DI	U.S. Department of the Interior
DO	District Office, Bureau of Land Management
DPASS	Division of Public Assistance and Social Services
EA	environmental assessment
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
EPRB	Eastern Powder River Basin
FCLAA	Federal Coal Leasing Amendments Act of 1976
FLPMA	Federal Land Policy and Management Act of 1976
FMV	fair market value
FR	Federal Register
FS	Forest Service, U.S. Department of Agriculture
FWS	U.S. Fish and Wildlife Service, Department of the Interior
GAGMO	Gillette Area Groundwater Monitoring Organization
gpm	gallons per minute
GS	Geological Survey, U.S. Department of the Interior
KGS	known geologic structures
LBA	Lease-by-Application
LOS	level of service
LMU	logical mining unit
Mariah	Mariah Associates, Inc.
MBHFI	migratory birds of high federal interest
mgd	million gallons per day
mg/L	milligrams per liter
MPH	miles per hour
NAAQS	National ambient air quality standards
NAGRA	Native American Graves and Repatriation Act
NEPA	National Environmental Policy Act of 1969
NHPA	National Historic Preservation Act
NRHP	National Register of Historic Places
NWR	Northwestern Resources Co.
OSM	Office of Surface Mining Reclamation and Enforcement, U.S. Department of the Interior
PAP	permit application package submitted to obtain a permit to mine
PET	potential evapotranspiration
PMT	postmining topography
ppm	parts per million
PSD	prevention of significant deterioration
RCT	Regional Coal Team
RMP	Resource Management Plan
ROD	record of decision
ROW	right of way
SAR	sodium adsorption ratio
SCS	Soil Conservation Service, U.S. Department of Agriculture
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SMCRA	Surface Mining Control and Reclamation Act of 1977
T or E	threatened or endangered
TDS	total dissolved solids
tpy	tons per year
TSP	total suspended particulates
TSS	total suspended solids
$\mu g/m^3$	micrograms per cubic meter
USDA	United States Department of Agriculture
VRM	visual resource management
WNDDB	Wyoming Natural Diversity Database
WRB	West Rocky Butte

EXECUTIVE SUMMARY

Northwestern Resources Company has applied for a coal lease under the lease-by-application regulations. The lease being applied for, called the West Rocky Butte tract, contains about 50 million tons of federal coal under 390 acres of private surface. The lease application tract is contiguous to the Rocky Butte lease, which Northwestern Resources Company has recently acquired.

The Rocky Butte lease will expire in February 1993. If the Bureau of Land Management holds a lease sale for the West Rocky Butte tract and if Northwestern Resources is the successful bidder, the two leases would be combined into a logical mining unit and a new diligence period would be established.

The Bureau of Land Management is required to take action on the lease application. The action considered is whether or not to hold a lease sale.

The holding of a lease sale would allow Northwestern Resources Company to acquire the lease, form a logical mining unit and open a new mine. As such, this would be a major federal action, and the Bureau of Land Management has determined that the action requires the preparation of an environmental impact statement.

Two alternatives are analyzed in this environmental impact statement. The first alternative is the Proposed Action, and this action would result in the holding of a lease sale and, assuming Northwestern Resources Company is the successful bidder, the forming of a logical mining unit with the Rocky Butte and West Rocky Butte tracts. The second alternative is to reject the lease application. The No Action Alternative is defined as the rejection of the lease application, in which case no lease sale would be held. It is assumed that under this second alternative the Rocky Butte Mine would not be constructed, at least not at this time.

Other alternatives were considered but not analyzed in detail because they were considered unreasonable or they would result in impacts similar to one of the two primary alternatives.

While selection of the Proposed Action would be a necessary action for the Rocky Butte Mine to open as planned, it is not the only action that would be required. Numerous permits must be acquired to open a mine, and while it was assumed for the purposes of environmental analysis that the permits could be acquired, no prejudgment that this is so is to be construed from this assumption.

The Rocky Butte Mine would join 18 operating mines in the area and would be part of a contiguous block of five mines south of Gillette. The other mines in this block are the Caballo, Belle Ayr, Caballo Rojo, and Cordero mines. The mine would add incrementally to the environmental effects of the other mines in the region, but no significant adverse impacts have been identified that cannot be mitigated through normal operating procedures or special lease or permit conditions. Impacts of the two alternatives are summarized in Table 4-1 of Chapter 4.

1.0 INTRODUCTION

1.1 General Location

On December 3, 1990, Northwestern Resources Co. (NWR) filed an application for a coal lease (the West Rocky Butte tract) on federal coal located west of and adjacent to Federal Coal Lease WYW-78633, otherwise known as the Rocky Butte tract. This application was made to the Bureau of Land Management (BLM) pursuant to provisions of 43 CFR 3425.1 as a Lease-by-Application (LBA).

The subject area is located approximately 10 miles southeast of Gillette, Wyoming (Figure 1-1). The existing Rocky Butte lease tract comprises approximately 4,910 acres and contains approximately 575 million tons of coal. This lease was issued to Texas Energy Services, Inc. and Northwestern Mutual Life Insurance Co. (collectively, TESI) in February 1983. The Rocky Butte lease has been acquired from TESI by NWR, a subsidiary of Western Energy Company, which in turn is a wholly-owned subsidiary of Montana Power Company. The LBA area encompasses approximately 390 acres and contains about 50 million tons of federal coal.

If the West Rocky Butte (WRB) tract is acquired by NWR, it will be combined with the Rocky Butte lease tract into a Logical Mining Unit (LMU). Combining the two tracts into an LMU will enable NWR to produce higher-quality coal, achieve maximum economic recovery of the public coal resource, and preserve the existing federal coal lease. Figure 1-2 shows the location of the WRB tract with respect to the existing Rocky Butte lease tract and the mine permit boundary that would encompass the coal removal areas as well as associated disturbances for overburden benching, stockpiling, and construction of facilities such as an office, shop, railroad spur and loop, coal loading facilities and access roads. Figure 1-2 also shows two small areas which would be added by the BLM to the WRB tract under the Proposed Action to avoid bypassing coal (Option A area). This area consists of approximately 70 acres and contains about 9 million tons of federal coal.

1.2 Purpose and Need for Proposed Action

The acquisition of the WRB tract by NWR and the formation of an LMU with this tract and the Rocky Butte tract would enable the opening of a new mine. Under this scenario, the issuance of the lease constitutes a major federal action that could significantly affect "the quality of the human environment." Consequently, pursuant to Section 102 (2)(C) of NEPA, the processing of the WRB lease application requires the preparation of an Environmental Impact Statement (EIS). The BLM has prepared this DEIS to identify and analyze impacts on the quality of the human environment that would result from proposed federal action and its reasonable alternatives.

1.3 Authorizing Actions

The coal lease application for the WRB tract was submitted and will be processed and evaluated under the following authorities:

- Mineral Leasing Act of 1920, as amended,
- Multiple-Use Sustained Yield Act of 1960,
- National Environmental Policy Act of 1969, as amended (NEPA),
- Federal Coal Leasing Amendments Act of 1976 (FCLAA),
- Federal Land Policy and Management Act of 1976 (FLPMA), and
- Surface Mining Control and Reclamation Act of 1977 (SMCRA).

Additionally, the lease will be processed according to the Powder River Regional Coal Team (RCT) Operational Guidelines for Coal Lease-by-Applications (Powder River RCT, 1991). On October 31, 1989, the RCT made the recommendation to the Director of BLM that the Powder River Coal Production Region be decertified and, to assure federal and state cooperation in coal development, that the RCT should remain in place to periodically review coal leasing in the region. These recommendations were accepted by the BLM Director and announced in the January 9, 1990

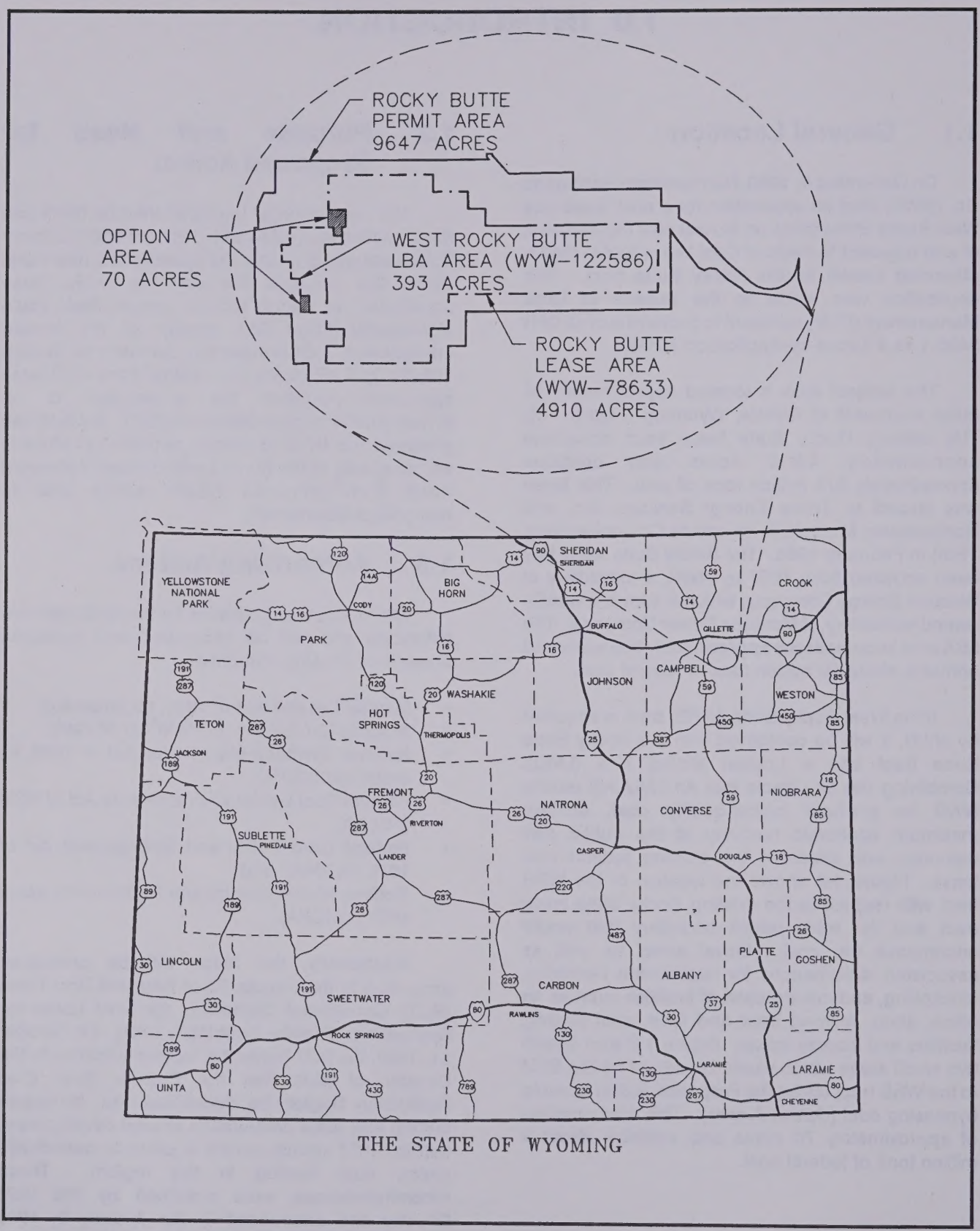


Figure 1-1. General Location Map for the West Rocky Butte LBA Area

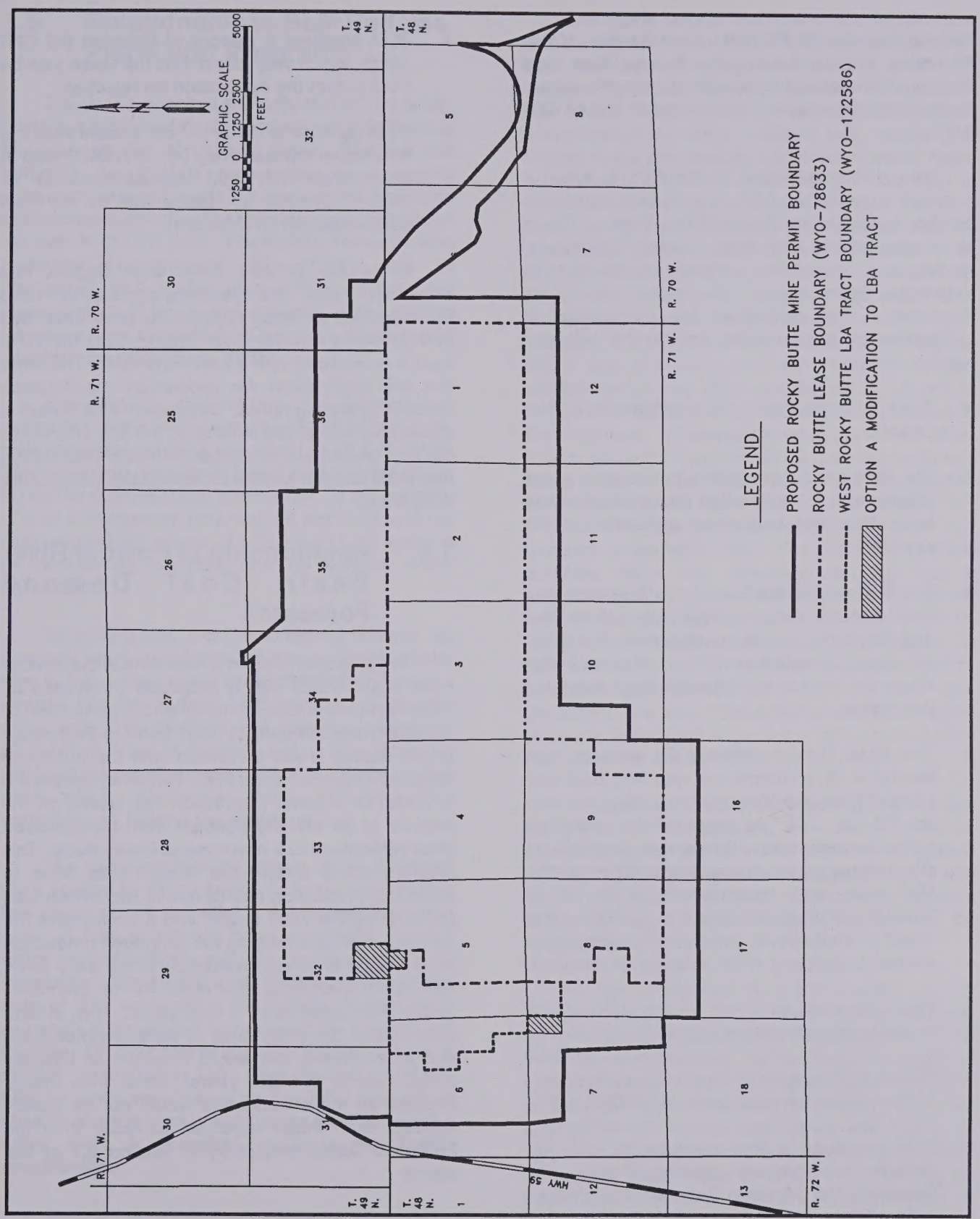


Figure 1-2. Location Map of Rocky Butte Tract, West Rocky Butte LBA Tract and Proposed LMU Permit Area

Federal Register (55 FR 784). As of the date of that FR notice, all federal coal in the Powder River Coal Region will be leased competitively using the lease-by-application procedures as defined at Title 43 CFR 3425.

The recommendation of the RCT included a provision to retain the RCT as an oversight body to monitor leasing in the Powder River Region. This is to assure federal and state cooperation in coal leasing and to provide a review mechanism to determine when and if the region should be recertified. The guidelines for processing an application for a coal lease include the following requirements:

- The application must be filed with the BLM State Director.
- The BLM announces to the public via a press release and FR notice that the application has been filed and begins an evaluation of the application.
- The BLM notifies the Governor of the respective state that the lease application has been filed and invites the State to participate in the NEPA process. Consultation with any affected Indian tribes may be accomplished through a copy of this notice.
- The BLM District Office (DO) assures that leasing is in conformance with any land use plans or Resource Management Plans; prepares an EA or EIS, as appropriate; develops mitigation measures which warrant special lease stipulations; prepares a geologic report on the LBA area; and recommends to the State Director any modification to the application that would promote better competition or maximum economic recovery of the federal coal resource.
- The BLM prepares a Fair Market Value (FMV) assessment of the lease application tract.
- The BLM through the applicant obtains any surface owner consent required (43 CFR 3427).
- BLM conducts a final consultation with the surface management agency, if any, the Governor, the Attorney General, and affected Indian Tribes.
- BLM prepares a Record of Decision (40 CFR 1500), which may direct that the lease sale be held or that the application be rejected.
- If the decision is made to hold a lease sale, it is conducted competitively (43 CFR 3422) and in accordance with BLM Manual/Handbook H-3420-1, Chapter 4. Lease awards are then conducted (43 CFR 3422.4).

Since the Powder River Coal Region was decertified and the lease-by-application rules promulgated, six lease applications have been filed in Wyoming's Powder River Basin. Only the WRB tract is associated with a new mine start. The other five are applications for production maintenance tracts at operating mines. Because the WRB tract is associated with a new mine start, this EIS addresses the environmental and socioeconomic impacts of the new mine and not just the incremental impacts of the WRB tract.

1.4 Relationship to Powder River Basin Coal Demand Forecasts

The proposal to open a new mine in the Powder River Basin (PRB) with a proposed production by 1995 of 8 million tons annually and a production of 16 million tons annually by 1997 (refer to Section 2.1 of this report) is not consistent with the published demand forecasts for the PRB. However, there is the potential for a lower production rate based on the transfer of an existing contract from the Rosebud Mine in Montana to a new mine at Rocky Butte. This contract could enable the Rocky Butte Mine to achieve a production rate of one to two million tons annually by the 1995 target, and it would have the general effect of changing the proposed production schedule by lowering production in the early years and either extending the mine life or permitting higher production rates in later years. This, in turn, would lower the initial rates of surface disturbance and employment, but would lengthen or intensity these impacts in future years. Other than timing, impacts on the environment would not be greatly different from those expected to result from the Proposed Action described in Section 2.1 of this report.

1.5 Relationship to BLM Policies, Plans and Programs

The BLM's principal authority to manage public lands is established by the Federal Land Policy and Management Act of 1976 (FLPMA). Through this authority, the BLM is responsible for managing resources on public lands in a manner that maintains or improves them. The BLM planning regulations are set forth in 43 CFR 1600. The Buffalo Resource Area Resource Management Plan (RMP) and its associated EIS is the plan which governs the management of lands and minerals in the Buffalo Resource Area, consisting of Campbell, Johnson and Sheridan counties (BLM, 1985).

The plan for coal leasing and development presented in the RMP was developed following the coal screening process described in 43 CFR 3420. This screening process included the following steps: (1) call for coal resource information, (2) assessment of coal development potential, (3) application of the coal unsuitability criteria (43 CFR 3461), (4) analysis of multiple-use conflicts, and (5) surface owner consultation.

Regarding step 1 of the screening process, no new coal resource information was received. Under step 2, four review areas were identified and carried forward into the Buffalo RMP comprising 963,000 acres with coal development potential containing 80.7 billion tons of federal coal. The proposed Rocky Butte permit area is within the Gillette Review Area which comprises about 154,000 acres containing 11 billion tons of federal coal.

The coal unsuitability criteria (step 3 above) were applied to all the known federal coal land that has development potential in the Buffalo Resource Area. A total of 144,000 acres containing about 9 billion tons of federal coal were declared unsuitable for leasing. About 2,400 acres containing 200 million tons of coal were within the Gillette Review Area. Appendix A provides a summary of the unsuitability findings. On the basis of the 1985 RMP and the field studies conducted in 1991 (See Section 3.0 of this EIS) no lands were found on the WRB tract which would make the tract unsuitable for leasing, and the entire tract is therefore available for further consideration.

The fourth step in the coal screening process was a multiple use analysis of the federal coal lands that remained available for leasing after the unsuitability criteria had been applied. This included the entire WRB tract. The review involved consideration of other multiple use values (not related to the unsuitability criteria) that would make an area unsuitable for coal mining. This step is intended to identify conflicts and make planning decisions that may preclude coal leasing, such as designation of community buffers, completion of oil and gas development before coal development can begin, or setting aside lands for recreation and public purpose uses. As a result of this multiple use analysis, a total of 221,000 acres containing 23 billion tons of federal coal were found to contain conflicts which may affect coal leasing. Only one of these conflicts, oil and gas development, applies to the WRB tract. Oil and gas production occurs within known geologic structures (KGSs) on the north and south sides of the WRB tract. Land use studies conducted in 1991 (see Section 3.14 of this EIS) show that there are active oil and gas wells on and adjacent to the WRB tract. The presence of these activities does not preclude leasing, but a determination is required that coal development will not interfere with the economic recovery of the oil and gas or that such conflicts can be mitigated. In the case of the WRB tract, the potential conflicts between coal development and oil and gas production are insignificant because the producing wells are scheduled to go out of production before their locations are scheduled to be mined.

The final step in the coal screening process was surface owner consultation. No surface owner on the WRB tract expressed a preference against leasing. NWR has reached agreements to mine with the current resident surface owners, and therefore ownership and surface consent would not be constraints to leasing.

At the September 6, 1991 meeting of the Regional Coal Team (RCT), the decision was made for the BLM to continue with the processing of the WRB lease application. At that time the applicant was instructed by the RCT to meet with the BLM to discuss the steps necessary to process the lease application and assure compliance with NEPA. In response to these instructions, a meeting was held at the BLM State Office in Cheyenne, Wyoming on September 17, 1991 between representatives of

NWR, BLM, the Office of Surface Mining Reclamation and Enforcement (OSM), and the Wyoming Governor's Office. Major decisions resulting from these two meetings were:

- BLM will process the WRB lease application as a Lease-by-Application under 43 CFR 3425.
- Because the issuance of the lease will result in new mine start, compliance with NEPA will require the preparation of an EIS prepared under the BLM format (BLM, October 1988).
- The schedules for the lease processing and EIS publication were established to accommodate a lease application sale date of October 16, 1992.
- OSM will be a cooperating agency for the preparation of this EIS and may prepare a separate environmental analysis prior to recommending final action on the mining plan.

Issues identified during the scoping process center around air quality, hydrology, noise, reclamation and socioeconomics as they relate to a new mine start. Short- and long-term impacts of the new mine, as well as cumulative impacts of this mine in conjunction with other mines in the region, were identified as issues during the scoping process. BLM considered each issue and concern raised during the scoping process in terms of its relevance to the proposed action. This EIS addresses the issues identified during the scoping process and provides an additional basis for public review of the proposed mine plan and the BLM's decision-making process.

1.6 Additional Permit Requirements

While the decision to lease the WRB tract is a necessary requisite for the opening of the Rocky Butte Mine, it is not in itself the enabling action that will lead to the opening of a new mine. Numerous permits must be acquired from a variety of regulatory agencies. Foremost among these is a permit to mine from the Wyoming Department of Environmental Quality, Land Quality Division (DEQ/LQD). All the issues raised during scoping will be fully resolved prior to completion of all necessary permitting activities.

The Surface Mining Control and Reclamation Act of 1977 (SMCRA) gives OSM primary responsibility to administer programs that regulate surface coal mining operations on federal lands and the surface effects of underground coal mining operations on these same lands. Pursuant to Section 503 of SMCRA, the Wyoming DEQ developed, and the Secretary of the Interior approved, a permanent program authorizing Wyoming DEQ to regulate surface coal mining operations and the surface effects of underground coal mining on non-federal lands within the State of Wyoming. In January 1987, pursuant to Section 523(c) of SMCRA, Wyoming DEQ entered into a cooperative agreement with the Secretary of the Interior authorizing Wyoming DEQ to regulate surface coal mining operations and the surface effects of underground mining on federal lands within the State.

Pursuant to the cooperative agreement, federal coal lease holders in Wyoming must submit permit application packages (PAPs) to OSM and Wyoming DEQ for proposed mining and reclamation operations on federal lands in the State. Wyoming DEQ reviews each PAP and determines whether the coal mining operation will meet the performance standards of the approved permanent program; if it does comply, Wyoming DEQ issues the lessee a permit to conduct coal mining operations. OSM and other federal agencies review the PAP to ensure that it complies with the terms of the coal lease, the requirements of the Mineral Leasing Act of 1920, NEPA, and other applicable federal laws and their attendant regulations. OSM recommends approval, approval with conditions, or disapproval of the mining plan contained in the PAP to the Assistant Secretary for Land and Minerals Management. The BLM and the surface-managing agency (if that agency is not BLM) must concur with this recommendation.

Wyoming DEQ enforces the performance standards and permit requirements during operation of the mine and has primary authority in emergency environmental situations. OSM retains oversight responsibility for this enforcement. BLM has authority in those emergency situations where Wyoming DEQ or OSM inspectors are unable to take action before significant harm or damage to the environment occurs.

In anticipation of acquiring the WRB tract, NWR is conducting baseline studies and designing a mining and reclamation plan for the LMU. This information will be incorporated into the PAP and submitted to Wyoming DEQ/LQD in the spring of 1992. Typically, several rounds of review by Wyoming DEQ/LQD and responses by the applicant are required before a mine permit application can be approved. Prior to issuance of the permit, opportunity is provided for public review of the mining and reclamation plan. If objections are filed, an administrative hearing is held before a final decision is made regarding the permit. The BLM reviews the mine plan for compliance with the Resource Recovery and Protection Plan requirements (43 CFR 3484).

Another major permit that must be acquired is an air quality permit from Wyoming DEQ, Air Quality Division (AQD). Prior to issuance of an air quality permit, there is another opportunity for public review and, if objections are filed, a public hearing.

NWR will be required to obtain numerous additional regulatory permits including, but not necessarily limited to:

- permits to appropriate surface and ground water from the Wyoming State Engineer's Office
- permits to construct sediment-control and other water treatment facilities from Wyoming DEQ, Water Quality Division (WQD)
- a permit to discharge treated wastewater, also from WDEQ/WQD.
- an industrial siting permit from the Wyoming Industrial Siting Administration.

These permits provide opportunities for the public to review and comment if they believe they may be adversely affected by the proposed activity being permitted.

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 Introduction

Under the lease-by-application regulations discussed in the previous chapter, the BLM must take action on the WRB lease application. If the action is the holding of a lease sale, and if the lease is acquired by the applicant and an LMU is formed, enabling a new mine start, then the BLM action is a major federal action requiring the preparation of an EIS. As an alternative, the BLM action could be to reject the WRB lease application.

For the purpose of this EIS, the first alternative (i.e., the holding of a lease sale and the assumption that this would enable the formation of an LMU and the opening of a new mine) is termed the Proposed Action. The second alternative (i.e., the rejection of the lease application), is assumed to result in the expiration of the Rocky Butte lease and therefore no new mine start at this time. This alternative is defined for the purposes of this document as the No Action Alternative.

Section 2.3 of this chapter lists other alternatives which were considered during scoping for this DEIS but were not analyzed in detail.

The lands included in the lease application are located as follows:

Township 48 North, Range 71 West, Campbell County, Wyoming

Section 5: Lots 8, 9, 16 and 17 and S½ and NW¼ Lot 7
Section 6: Lot 8, E½ Lot 14, Lots 15, 16, E½ Lot 23
Section 8: Lot 4

Total Area: 393.04 acres, more or less

This legal description and acreage are based on approved U.S. Department of the Interior BLM mineral plats on file at the Buffalo Area Office.

In order to avoid bypassing certain coal, the BLM would, as Option A to the Proposed Action, add the following lands to the WRB tract:

Township 48 North, Range 71 West, Campbell County, Wyoming

Section 5: NE¼ Lot 7
Section 7: E½ Lot 5

Township 49 North, Range 71 West, Campbell County, Wyoming

Section 32: Lot 9

Total Area: 70.36 acres, more or less

The 393.04 acres in the lease application area contain approximately 50 million tons of recoverable coal. The area included in Option A contains about 9 million tons of recoverable coal. About 575 million tons of coal are contained in the Rocky Butte lease tract. Therefore, combining the WRB LBA area with the Rocky Butte lease brings the total recoverable coal in the LMU to about 625 million tons (634 million tons with Option A).

2.2 Description of Proposed Action

Under the Proposed Action, it is assumed that the WRB tract would be combined with the Rocky Butte lease into an LMU. A new mine would open in 1993 according to NWR's plans. The mine layout and pit progression are illustrated on Figure 2-1. Table 2-1 summarizes the material handling sequence for the life of the mine. The mine plan calls for construction of the facilities (access road, plant, railroad, and initial pit) in the first two years (1993 and 1994), coal production beginning at a rate of 8 million tons per year (tpy) in the third year (1995) and occurring at a constant rate of 16 million tpy for 37 years (1997 through 2033), and final reclamation in year 2034. This mine plan is tentative and may undergo substantial revision during review of the mine permit application by the Wyoming DEQ/LQD.

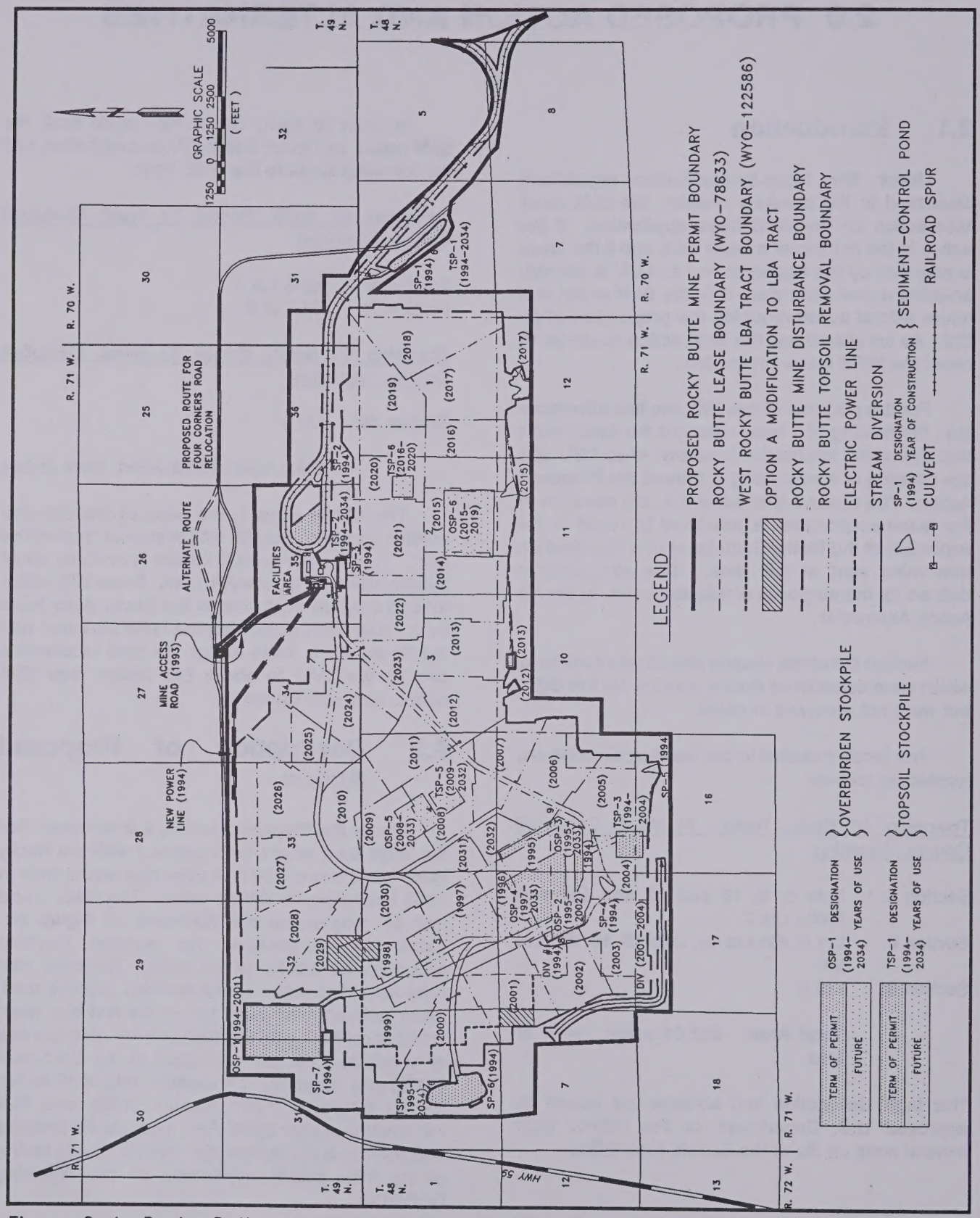


Figure 2-1. Rocky Butte Mine Layout and Pit Progression

Table 2-1. Life-of-Mine Mass Balance for the Rocky Butte Mine

Year	Topsoil (thousand cubic yards)			Overburden (thousand loose cubic yards)			Coal Mined (thousand tons)	Affected Area (acres)		
	Stripped	Replaced	in Stockpile	Stripped	Backfilled	in Stockpile		Disturbed	Reclaimed	Cumulative Disturbed
1993	2600	150	2450	0	0	0	0	412	21	392
1994	3653	0	6103	14608	0	14608	0	509	0	901
1995	792	0	6895	27449	18417	23640	8000	117	0	1018
1996	570	0	7465	31081	26155	28566	8000	81	0	1099
1997	1180	0	8645	60491	51524	37533	16000	158	0	1257
1998	1780	0	10425	67103	51441	53195	16000	241	0	1497
1999	1550	347	11628	85701	69066	69830	16000	250	50	1697
2000	1157	1575	11210	80098	89387	60541	16000	181	225	1654
2001	1651	2788	10073	63961	81645	42857	16000	252	397	1509
2002	703	1259	9517	58136	72568	28425	16000	143	180	1473
2003	964	1311	9170	60485	66767	22143	16000	180	187	1465
2004	566	1361	8375	62118	63570	20691	16000	95	194	1366
2005	962	962	8375	63264	63264	20691	16000	193	137	1423
2006	1000	1000	8375	59644	59644	20691	16000	210	143	1490
2007	683	683	8375	49408	49408	20691	16000	139	98	1532
2008	1193	1193	8375	46171	46171	20691	16000	156	170	1518
2009	1076	1239	8212	59367	59367	20691	16000	156	177	1497
2010	1150	324	9038	58813	52347	27157	16000	143	46	1594
2011	1176	1149	9065	52193	61351	17999	16000	146	164	1576
2012	1000	917	9148	41431	45188	14242	16000	150	131	1595
2013	1150	1011	9287	43808	43808	14242	16000	185	144	1636
2014	1291	1144	9434	52310	52310	14242	16000	186	163	1659
2015	1528	774	10188	58025	51409	20858	16000	204	110	1753
2016	1472	713	10947	59736	53611	26983	16000	192	102	1844
2017	1558	1537	10968	38031	42096	22918	16000	225	219	1850
2018	1702	1530	11140	40606	42892	20632	16000	219	218	1851
2019	1553	1486	11207	42721	47128	16225	16000	192	212	1832
2020	1498	1809	10896	47364	52031	11558	16000	187	258	1761
2021	1332	1332	10896	66090	66090	11558	16000	187	190	1758
2022	1321	1321	10896	61212	61212	11558	16000	168	188	1737
2023	1256	1256	10896	55869	55869	11558	16000	156	179	1714
2024	1380	1380	10896	70144	70144	11558	16000	174	197	1691
2025	1186	1186	10896	82678	78355	15881	16000	151	169	1673
2026	1736	1736	10896	91609	91609	15881	16000	215	248	1640
2027	1585	1577	10904	80895	80895	15881	16000	196	225	1612
2028	1791	1791	10904	77524	57319	36086	16000	225	255	1582
2029	1034	1472	10466	75012	78370	32728	16000	141	210	1513
2030	592	2043	9015	82381	86331	28778	16000	75	291	1296
2031	699	1367	8347	79692	79692	28778	16000	87	195	1188
2032	371	1665	7053	73652	76581	25849	16000	55	237	1006
2033		4253	2800	33646	59495	0	16000		606	400
2034		2800	0	0	0	0	0		399	0
Totals	51441	51441		841779	2354527		608000	7333	7333	

In this EIS the following terms and acreages are used to describe the various lease tracts and the permit area:

- WRB lease tract 393.04 acres
- WRB lease tract Option A 70.36 acres
- Rocky Butte lease tract 4,909.98 acres
- permit area 9,647 acres
- disturbed area 7,333 acres

Of the total permit area of 9,647 acres, only 7,333 acres will be actually disturbed.

The 608 million tons of coal produced over the life of the mine shown on Table 2-1 represents greater than 97 percent recovery of the estimated 625 million tons in the LMU. The volumetric statistics shown in Table 2-1 do not fully consider the coal and associated acreage that would be disturbed under Option A, although much of this area would be affected by overburden benching even if the coal is not added to the lease.

A total of 51.4 million cubic yards of topsoil would be salvaged and replaced, averaging about 4.3 feet in thickness over the disturbed area. A total of 1.956 billion bank cubic yards of overburden would be removed and replaced over the life of the mine. This represents a stripping ratio of about 3.1 cubic yards of overburden per ton of coal.

The mining production sequence planned for the Rocky Butte Mine is similar to that employed at other operating coal mines in Campbell County. Topsoil would be removed and stockpiled prior to initial overburden drilling and blasting. Overburden removed from the initial pit would be stockpiled as well. As mining proceeds, the sequence becomes a continuous operation with topsoil being stripped in advance of the pit and hauled directly to graded spoils behind the pit. Following blasting, overburden is removed from the advancing face and replaced directly behind the pit. While some stockpiling is necessary due to pit turns, variations in overburden thickness and other factors, it is minimized to avoid the added expense of moving the material more than once. The replaced overburden is graded and the area is then reclaimed in accordance with the reclamation plan presented in Appendix B.

Following overburden removal, the coal is blasted, loaded into trucks and transported to a crushing station. From there, the coal is conveyed to a storage and loadout facility for unit-train transportation to the market place.

The mine plan was developed such that the western (highest quality) portion of the reserve would be developed first (Figure 2-1). The quality of the coal on the Rocky Butte tract is typically 500 to 800 British thermal units per pound (Btu/lb) higher on the western portion of the lease. The effect of this higher quality is a price premium for this coal compared with the coal in the eastern portion of the Rocky Butte lease. Additionally, the western portion is compliance coal with a sulfur content yielding substantially less than 1.2 pounds of sulfur dioxide per million Btu. Coal in the eastern portion typically contains sulfur in amounts near or in some instances above the 1.2 pounds per million Btu compliance limit. The coal in the WRB tract is of similar quality to that in the western part of the Rocky Butte lease. The mine plan was designed by NWR to minimize the strip ratio in earlier years to the extent possible while recovering the higher quality coal.

The mine plan proposes a dragline as a primary overburden removal tool for optimal economics. This requires nominal pit lengths of at least one-half mile. This operational constraint, along with the strip ratio, dictate the mine layout. As shown on Figure 2-1, coal from the WRB tract would be mined shortly after startup (approximately 30 million tons into the mine or within the first three years of coal production). In actuality, coal production rates would be dictated by market conditions. The production scenario reflected in Table 2-1 is believed to be a conservative case on which to base the impact analysis of Chapter 4.0.

NWR believes that adding the coal in the WRB tract provides enough low strip ratio, high quality, compliance coal to justify the development expense of mining coal west of a high-strip-ratio ridge which extends through Sections 32, 5 and 9 (Figure 2-1). Additionally, it avoids bypassing this significant tonnage.

The mine plan would recover all federal coal in both the Rocky Butte tract and the WRB tract as described in the LBA. The final highwall is in close proximity to the initial box cut, facilitating final reclamation efforts by allowing the material from the box-cut stockpile to be transported to the final pit.

The overburden would be mined with a dragline, all-purpose shovels and trucks. Table 2-2 presents a summary of anticipated equipment and operator requirements for the life of the mine.

Table 2-2. Rocky Butte Mine Equipment Requirements

YEAR	Haul Trucks	Scrapers	Graders	Shovels	Draglines	Dozers	Loaders	Water Wagons	Drills	Operators
1993	0	2	1	0	0	10	2	6	3	96
1994	9	3	3	2	0	10	2	6	3	160
1995	10	3	4	2	1	10	2	6	3	176
1996	9	2	4	4	1	10	2	6	3	184
1997	14	2	5	6	1	10	2	6	3	224
1998	15	3	6	2	1	10	2	6	3	204
1999	20	4	7	2	1	10	2	6	3	232
2000	15	4	6	8	1	10	2	6	3	256
2001	16	7	7	7	1	10	2	6	3	268
2002	13	3	5	7	1	10	2	6	3	232
2003	14	3	5	6	1	10	2	6	3	228
2004	12	3	5	6	1	10	2	6	3	220
2005	13	3	5	6	1	10	2	6	3	224
2006	12	3	5	6	1	10	2	6	3	220
2007	11	2	4	5	1	10	2	6	3	200
2008	9	3	4	5	1	10	2	6	3	196
2009	11	2	4	6	1	10	2	6	3	208
2010	10	2	4	6	1	10	2	6	3	204
2011	8	3	4	6	1	10	2	6	3	200
2012	7	3	3	5	1	10	2	6	3	184
2013	6	3	3	5	1	10	2	6	3	180
2014	8	3	3	5	1	10	2	6	3	188
2015	10	5	4	6	1	10	2	6	3	216
2016	10	5	4	6	1	10	2	6	3	216
2017	8	4	4	4	1	10	2	6	3	188
2018	8	4	4	4	1	10	2	6	3	188
2019	9	4	4	5	1	10	2	6	3	200
2020	11	4	4	5	1	10	2	6	3	208
2021	11	4	4	6	1	10	2	6	3	216
2022	9	3	4	6	1	10	2	6	3	204
2023	8	3	3	5	1	10	2	6	3	188
2024	10	4	4	6	1	10	2	6	3	212
2025	12	3	5	7	1	10	2	6	3	228
2026	14	4	5	8	1	10	2	6	3	248
2027	11	4	4	7	1	10	2	6	3	224
2028	17	5	6	7	1	10	2	6	3	260
2029	13	4	5	7	1	10	2	6	3	236
2030	12	4	5	8	1	10	2	6	3	240
2031	11	3	4	7	1	10	2	6	3	220
2032	10	3	4	7	1	10	2	6	3	216
2033	9	10	4	6	1	10	2	6	3	232
2034	0	2	1	0	0	10	2	6	3	96

Support facilities for the Rocky Butte Coal Mine include an office; shop; warehouse; employee change facility; coal crushing, handling, and loadout facilities; and smaller facilities such as a power transmission network and solid waste disposal site (Figure 2-1).

The main office for the Rocky Butte Coal Mine will house mine operations, engineering, environmental, accounting, payroll, computer, safety and quality control departments. Additional structures in the complex include a diesel and gasoline fueling station for both large mobile mine equipment and mine pickup truck fleet. Mobile equipment and employee parking areas will be provided at the complex.

The coal crushing, handling, and loadout facilities will include the following: raw coal storage area, truck dump, primary crushers, sampling location, covered conveyors, coal storage facilities, and a train loadout facility (Figure 2-1). All facilities including the transportation facilities, are subject to final design pending the outcome of the lease sale and the mining permit application.

In addition to the equipment operators shown in Table 2-2, the mine will employ support laborers and technical, professional and clerical staff. Table 2-3 presents the predicted employment requirements by job type over the life of the mine.

Utility requirements for the mine will include electric power, telephone and water. Power will be required to operate the dragline, shovels, and plant and office facilities. This power will be supplied by Tri-County Electric Association, which purchases wholesale power from the Basin Electric Power Cooperative, headquartered in Bismark, North Dakota. Energy requirements are expected to average up to four or five million kwh per month. Telephone service is provided by Mountain States Telephone and Telegraph.

The major water requirement is for dust control on haul roads. Water is also required for equipment washdown, drinking, showers in the change house, and sanitary purposes. Dust control water will be supplied from water collected in the pit, from sediment and wastewater treatment ponds, and, as necessary, from wells. Total water requirements for all uses at the mine are expected to average around 150 to 200 gallons per minute based on other mines in the region with similar production rates and disturbance schedules. Portions of the area to be mined contain extensive saturated sandstone bodies in the overburden. Dewatering of these sands during mining is expected to provide the required dust control and equipment washdown water. These sandstone bodies are most prevalent in the western half of the mine area. In the unlikely event that the overburden sands cannot provide all the water needed, a deep well will be drilled and completed in sandstone intervals several hundred feet below the base of the coal. Drinking water will be purchased from a bottled-water service.

There are 16 operating coal mines in Campbell County (Figure 2-2). These are, from north to south, the Buckskin, Rawhide, Eagle Butte, Dry Fork, Fort Union, Wyodak, Caballo, Belle Ayr, Caballo Rojo, Cordero, Coal Creek, Jacobs Ranch, Black Thunder, North Rochelle, Rochelle, and North Antelope Mines. The Clovis Point and adjoining East Gillette Mines are permitted but are currently inactive. Because of the proximity of these other mines, this EIS includes an evaluation of cumulative impacts as well as those which result from the Rocky Butte Mine alone. The Rocky Butte Mine will be contiguous with four other mines in a strip of land located along the coal outcrop south of Gillette. These four mines are (1) Caballo Mine, operated by The Carter Mining Company, a division of Exxon Coal USA; (2) Belle Ayr Mine, operated by Amax Coal Company; (3) Caballo Rojo, operated by Mobil Coal Producing, Inc.; and (4) Cordero, operated by Cordero Mining Company, a division of the Sun Company. A fifth mine, Coal Creek, operated by Thunder Basin Coal Company, a subsidiary of Arco Coal, is located a short distance southeast of the Cordero Mine. This EIS addresses regional impacts of all the mines in the county in a general way, and more detailed cumulative environmental impacts are addressed for this cluster of mines between the Rocky Butte and Coal Creek mines. The cumulative ground-water impact analysis in this EIS extends northward to include the Wyodak Mine.

2.3 No Action Alternative

The primary alternative to the Proposed Action is the No Action Alternative. Under this alternative, the BLM would disapprove the West Rocky Butte lease application and not lease the West Rocky Butte tract. No LMU would be formed, and the Rocky Butte Mine would not be developed at this time.

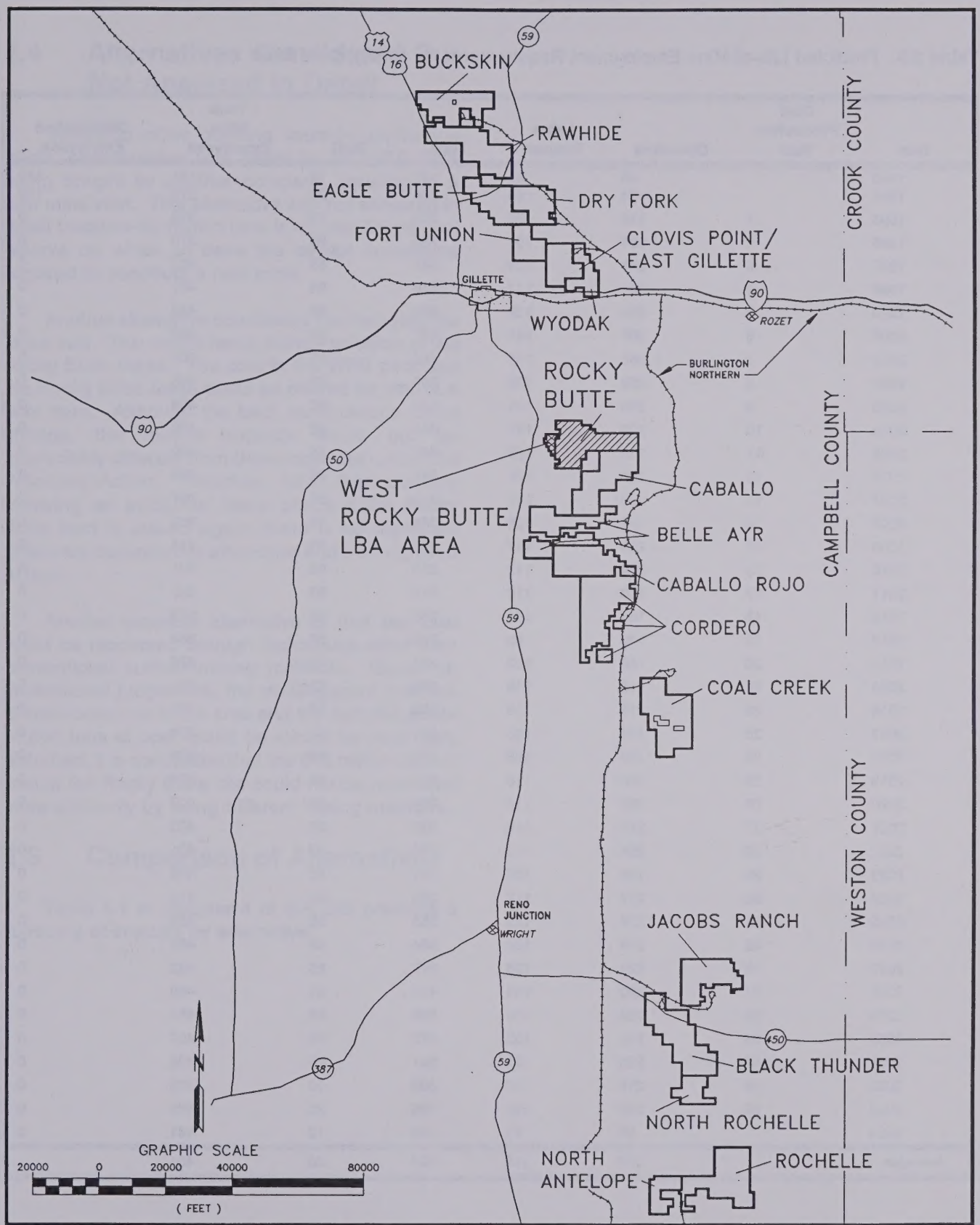


Figure 2–2. Locations of Coal Mines and Transportation Facilities in Campbell County, Wyoming

Table 2-3. Predicted Life-of-Mine Employment Requirements for Rocky Butte Mine

Year	Coal Production Year	Operators	Labor Support	Total	Staff	Total Mine Employees	Construction Employees
1993		96	53	149	12	161	125
1994		164	90	254	25	279	130
1995	1	176	97	273	50	323	0
1996	2	184	101	285	85	370	0
1997	3	224	123	347	85	432	0
1998	4	204	112	316	85	401	0
1999	5	232	128	360	85	445	0
2000	6	256	141	397	85	482	0
2001	7	268	147	415	85	500	0
2002	8	232	128	360	85	445	0
2003	9	228	125	353	85	438	0
2004	10	220	121	341	85	426	0
2005	11	224	123	347	85	432	0
2006	12	220	121	341	85	426	0
2007	13	200	110	310	85	395	0
2008	14	196	108	304	85	389	0
2009	15	208	117	329	85	414	0
2010	16	204	112	316	85	401	0
2011	17	200	110	310	85	395	0
2012	18	184	101	285	85	370	0
2013	19	180	99	279	85	364	0
2014	20	188	103	291	85	376	0
2015	21	216	119	335	85	420	0
2016	22	216	119	335	85	420	0
2017	23	188	103	291	85	376	0
2018	24	188	103	291	85	376	0
2019	25	200	110	310	85	395	0
2020	26	208	114	322	85	407	0
2021	27	216	119	335	85	420	0
2022	28	204	112	316	85	401	0
2023	29	188	103	291	85	376	0
2024	30	212	117	329	85	414	0
2025	31	228	125	353	85	438	0
2026	32	248	136	384	85	469	0
2027	33	224	123	347	85	432	0
2028	34	260	143	403	85	488	0
2029	35	236	130	366	85	451	0
2030	36	240	132	372	85	457	0
2031	37	220	121	341	85	426	0
2032	38	216	119	335	50	385	0
2033	39	232	128	360	25	385	0
2034		96	53	149	12	161	0
Averages		208	116	324	80	404	

2.4 Alternatives Considered But Not Analyzed in Detail

Similar to other pending lease-by-application tracts, consideration was given to the WRB tract being bought by another company, resulting in a new mine start. This alternative was not analyzed in detail because 50 million tons is an insufficient coal reserve on which to base the capital investment required to construct a new mine.

Another alternative considered was delaying the lease sale. This would result in the expiration of the Rocky Butte lease. The coal in the WRB tract and the Rocky Butte lease could be offered for sale at a later date. Although the tract configuration could change, the mining impacts would not be appreciably different from those analyzed under the Proposed Action. Therefore, other than possibly receiving an additional lease bonus if the Rocky Butte tract is leased again, there is no signficant difference between this alternative and the Proposed Action.

Another possible alternative is that the coal could be recovered through techniques other than conventional surface mining methods. Based on professional judgement, the development that has already occurred in the area and the fact that about 83,000 tons of coal would be mined for each acre disturbed, it is concluded that the 608 million tons of coal at the Rocky Butte site could not be recovered more efficiently by using different mining methods.

2.5 Comparison of Alternatives

Table 4-1 in Chapter 4 of this EIS presents a summary of impacts by alternative.

3.0 AFFECTED ENVIRONMENT

3.1 Geology and Mineral Resources

The proposed Rocky Butte permit area is located in the central portion of the Powder River Basin. The overburden in the area is part of the Eocene Wasatch formation. Although the Wasatch formation is dominated by claystones and siltstones, its composition is extremely variable, consisting of a complex interfingering of claystones, shales, siltstones, sandstones, and minor thin limestone beds within the proposed Rocky Butte permit area. Figure 3-1 shows a cross section developed from drill hole data. This cross section is fairly typical of the site, with the primary variable from place to place being the amount of sandstone in the overburden.

NWR proposes to mine the Wyodak-Anderson coal seam at the Rocky Butte Mine. This seam is the uppermost unit of the Tongue River member of the Fort Union formation. Two thin rider seams are located above the main seam in the overburden. The total thickness of the Wyodak-Anderson seam within the proposed permit area averages 67 feet and ranges from 55 to 72 feet. The coal does not crop out on the property. Approximately 625 million tons of in-place coal reserves exist within the proposed Rocky Butte permit area, of which roughly 608 million tons, or approximately 97 percent, would be mined. This tonnage represents about 0.03 percent of the estimated 21.2 billion tons of strippable coal within the Powder River Basin.

The overburden within the proposed Rocky Butte permit area ranges from 76 to 370 feet thick and averages approximately 195 feet thick. NWR obtained core samples from drill holes for the purpose of determining overburden geochemistry and reclamation suitability. Samples from several of these drill holes showed zones in the overburden that exceed Wyoming DEQ/LQD guideline limits for suitable texture, saturation percentage, pH, and nitrate-nitrogen. Samples from one of the holes showed a zone that exceeded recommendations for molybdenum. Samples from all of the holes showed zones that exceed recommendations for selenium. Roughly 60 percent of the sample intervals tested exceed the new selenium suitability guideline of 0.1 ppm. The selenium concentration is generally only marginally above this Wyoming DEQ/LQD guideline limit. Samples from all of the holes also showed zones that exceed recommendations for total organic carbon content. Data from additional holes are still being analyzed.

The companies at the other existing mines in the basin have also conducted overburden drilling and sampling programs to identify unsuitable overburden in their respective permit areas. The preliminary findings at the Rocky Butte Mine are within the range of overburden suitability values at these other mines.

The sampling programs have identified some overburden unsuitable for use in reclamation within all regional permit areas. The reasons overburden was found to be unsuitable have varied from mine to mine; the majority of the unsuitable overburden either contained high sodium adsorption ratios (SARs) or potentially acid-forming materials or had unsuitable texture. Excessive total carbon content is generally associated with non-minable carbonaceous zones at all of the mines. Concern for selenium concentrations in near-surface material within several of the Powder River Basin mines has prompted a recent reduction in suitability limits in surficial materials. The Wyoming DEQ/LQD and the mining companies are cooperating in defining the magnitude of the selenium problem and developing mitigation measures.

3.2 Topography

The proposed Rocky Butte Mine is in an area of low rolling terrain separated by broad subdued ephemeral drainages. The elevation within the proposed Rocky Butte permit area ranges from 4519 to 4758 feet above mean sea level. The average elevation is 4618 feet above mean sea level.

Approximately 87 percent of the proposed permit area has slopes of 5 percent or less. Only 13 percent has slopes greater than 5 percent. These percentages reflect the dominance of very flat surfaces in the permit area, both in the uplands and in major valleys. Playas, which are shallow closed drainages that pond water during wet seasons, are common. In areas where the more erosion-resistant

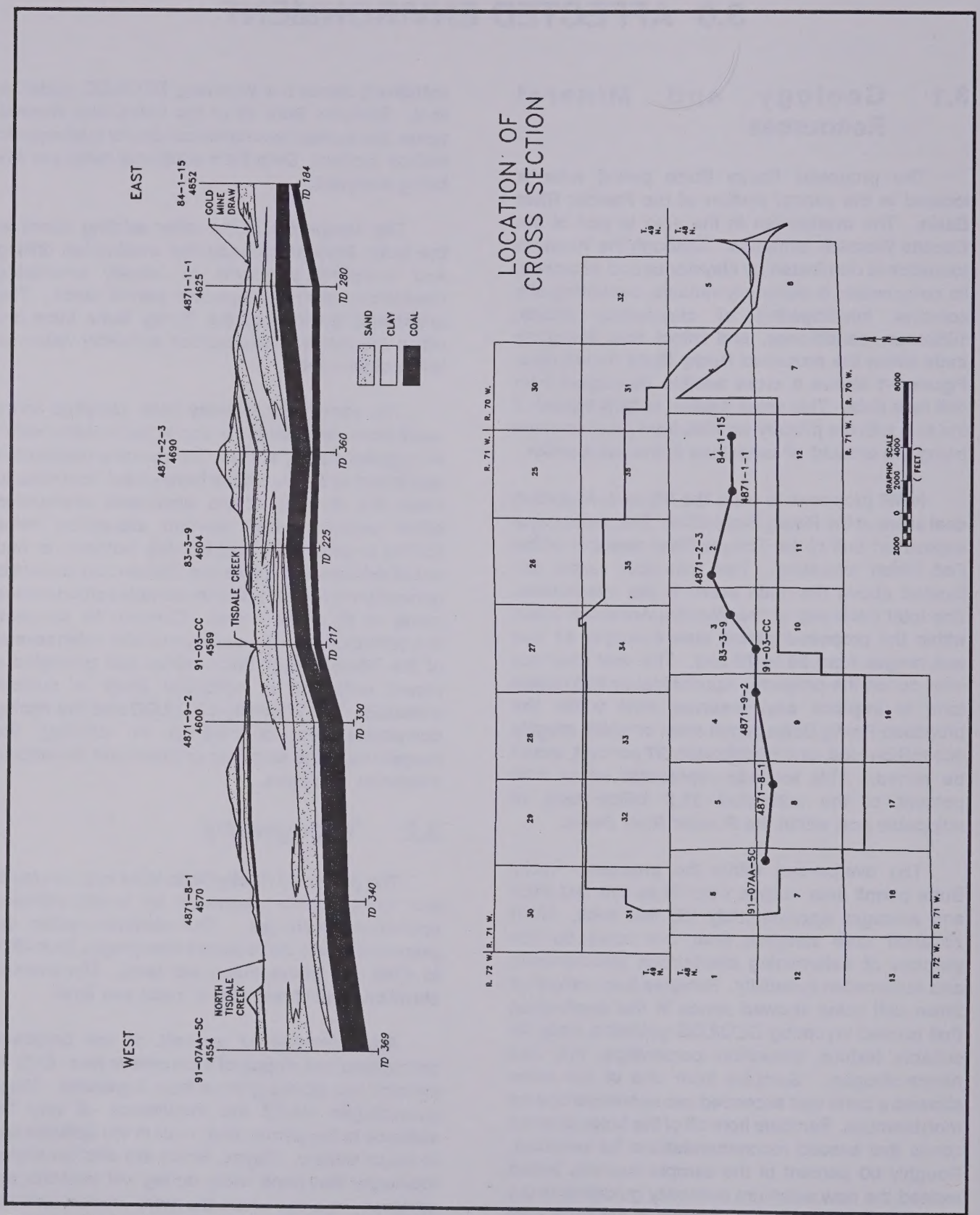


Figure 3-1. Generalized Geologic Cross Section in Proposed Rocky Butte Mine Area

rocks occur, buttes or plateaus often form. Buttes and plateaus are not common within the proposed mine area but can be found nearby.

Broad, nearly flat basins are the most striking topographic feature of the proposed mine area. A prominent northwest-southeast trending ridge in the western third of the proposed mine area reflects the presence of slightly more resistant sand units.

3.3 Soils

Soils in the permit area were mapped in 1991. The soils in the proposed permit area are classified into four broad taxonomic orders: 1) Aridisols; 2) Entisols; 3) Vertisols; and 4) Mollisols. These soils orders are common in Campbell County and northeastern Wyoming. The Aridisols comprise the majority of the soils on the broad, rolling uplands. The Aridisols are intergrading toward Mollisols and are usually dry for significant periods of the growing season. They have moderate accumulations of organic matter in the surface layers, and over a long period of time leaching has resulted in modest to strong accumulations of clay in subsoil horizons. Textures of soils within the Aridisol order in this area range widely from sand to clay and can vary within a short distance on the landscape.

Entisols are a much less extensive group of soils within the proposed permit area. They occur in small scattered areas on upper hillslopes and ridge crests where geologic erosion does not provide a stable surface for soil horizon development or on areas of recent alluvial deposition. Textures of Entisols vary widely from sand to clay and are strongly influenced by the interbedded underlying bedrock that ranges from sandstone to shale.

The Vertisol soil order occurs in some playas within the proposed permit area. Vertisols are clayey, have deep, wide cracks when dry, and are dense and massive between the cracks. These soils receive extra moisture that enhances their productivity.

A small area of Mollisols occurs in a concave basin within the central portion of the proposed permit area.

Soil suitability for use as topsoil during reclamation was evaluated according to Wyoming DEQ/LQD guidelines. All soils rated suitable or marginally suitable above 60 inches in depth were included in the "suitable" class. An exception to this is the very clayey soils in some playas where two feet of surface soil is rated as suitable for replacement on similar postmining playas and potholes.

Table 3-1 provides the extent of five depth classes of suitable topsoil in the proposed permit area and disturbed area. If all suitable topsoil to a depth of five feet is salvaged within the disturbed area, 31,900 acre-feet of topsoil will be available for use in reclamation. This would allow approximately 4.3 feet of topsoil to be replaced over the entire disturbed area.

Table 3-1. Acres of Topsoil for Reclamation Within the Proposed Permit Area and Disturbed Area

	Thickness of Suitable Topsoil (inches)				
	0	1-10	10-20	20-40	40-60
Acres in Permit Area[1]	128 (1)	738 (8)	157 (2)	1833 (19)	6801 (70)
Acres in Disturbed Area[1]	103 (1)	544 (7)	123 (2)	1328 (18)	5235 (71)

[1] Numbers in parenthesis indicate percent of total.

3.4 Vegetation

There are eight vegetation types in the WRB proposed mine permit area: cropland, big sagebrush, silver sagebrush, saline big sagebrush, upland grass, lowland grass, riparian and pasture (Figure 3-2). Cropland, including hay fields, is the most abundant vegetation type (Table 3-2). Winter wheat (*Triticum* spp.), hay (*Agropyron cristatum* plus *Medicago sativa*), barley (*Hordeum* spp.), and oats (*Avena* spp.) are the most commonly grown crops.

Table 3-2 Acreage of Vegetation Types Within the Proposed Disturbed Area and the Rocky Butte Permit Area, Campbell County, Wyoming.

	DISTURBED		PERMIT TOTAL	
Vegetation Type	Acres	Percent of Permit	Acres	Percent of Permit
Big Sagebrush	1,066	11	1,965	20
Silver Sagebrush	789	8	1,069	11
Saline Big Sagebrush	299	3	355	4
Upland Grass	835	9	987	10
Lowland Grass	124	1	134	1
Cropland	3,752	39	4,382	45
Pasture	327	3	579	6
Riparian	52	1	66	1
Disturbed	89	1	110	1
TOTAL	7,333	76	9,647	≈100

Shrublands, including big sagebrush, silver sagebrush, and saline big sagebrush types are typically dominated by either Wyoming big sagebrush (*Artemisia tridentata wyomingensis*) or silver sagebrush (*Artemisia cana*) or a mixture of the two. Common grasses and forbs in shrublands are Japanese brome (*Bromus japonicus*), cheatgrass (*Bromus tectorum*), needle-and-thread grass (*Stipa comata*), bluegrass (*Poa* spp.), blue grama (*Bouteloua gracilis*), western wheatgrass (*Agropyron smithii*), common yarrow (*Achillea millefolium*), and milkvetch (*Astragalus* spp.). Additional shrubs and subshrubs occurring in shrublands include winterfat (*Krascheninnikovia lanata*), rabbitbrush (*Chrysothamnus* spp.), and fringed sage (*Artemisia frigida*). In saline areas inland saltgrass (*Distichlis spicata stricta*), prairie cordgrass (*Spartina pectinata*), and alkali sacaton (*Sporobolus airoides*) are also common. Many of these species are also common in the upland and lowland grass types.

There are 33 riparian zones that support wetland plant species within the permit area (Reed, 1988). Twenty-eight riparian areas are within the proposed disturbed area. Because most riparian zones are associated with stockponds or reservoirs where levees have been constructed to hold water, they are not believed to be jurisdictional wetlands (U.S. Army Corps of Engineers et al., 1989). Riparian vegetation also occurs adjacent to springs or hollows in ephemeral channels and in one basin where there is a locally high water table. The common species are spikerush (*Eleocharis* spp.), arrowhead (*Sagittaria cuneata*), broadleafed cattail (*Typha latifolia*), scouringrush (*Equisetum variegatum*), and bulrush (*Scirpus* spp.).

Pastures within the permit area include improved native range dominated by crested wheatgrass. Pastures are undergoing succession to a more native state, with varying degrees of

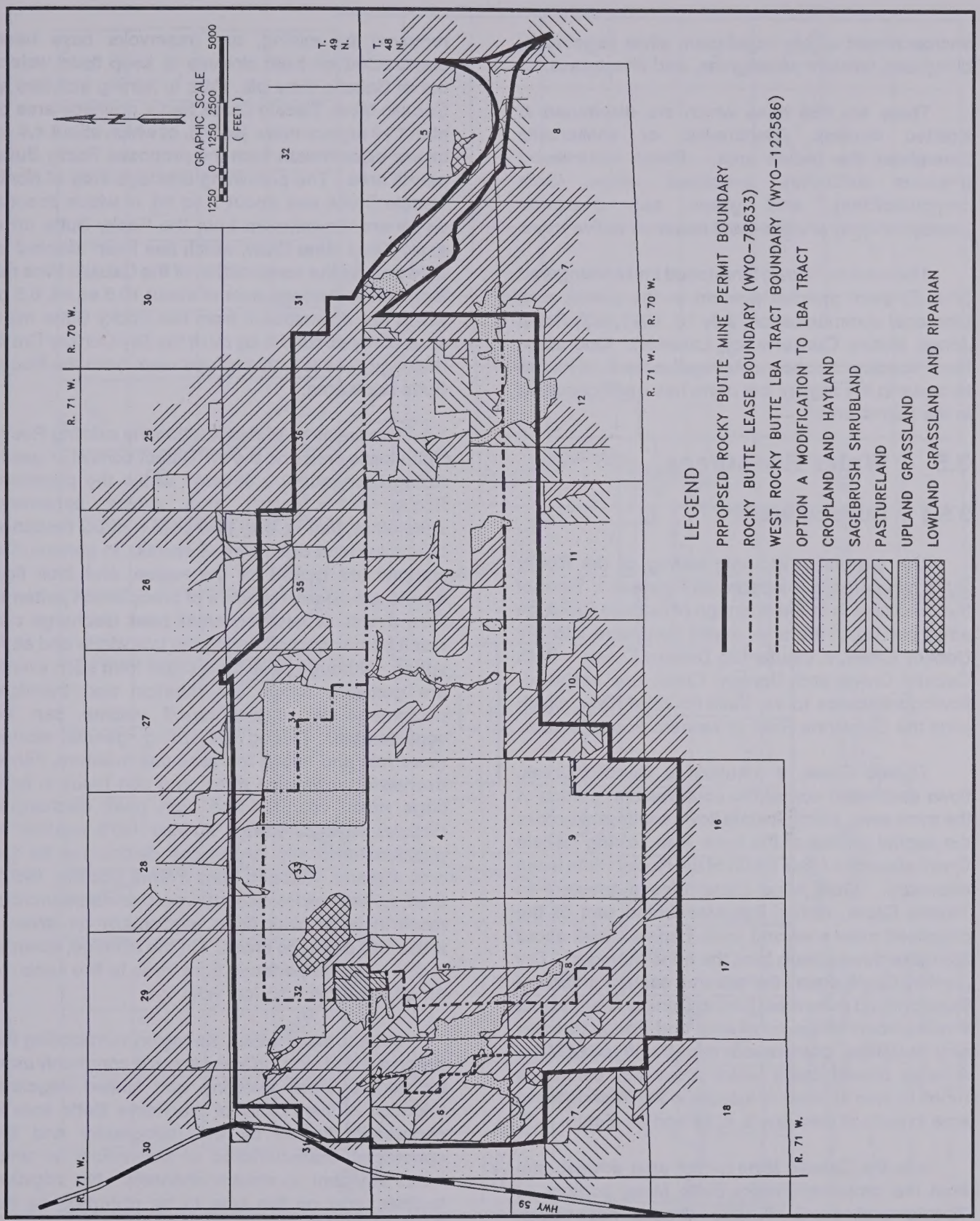


Figure 3-2. Vegetation Types On and Near the Rocky Butte Mine Area

encroachment of big sagebrush, silver sagebrush, bluegrass, western wheatgrass, and cheatgrass.

There are 688 trees which are distributed in isolated clusters, windbreaks, or shelterbelts throughout the permit area. Plains cottonwood (*Populus deltoides*), peachleaf willow (*Salix amygdaloides*), and green ash (*Fraxinus pennsylvanicus*) are the most common native trees.

There are no known threatened and endangered (T & E) plant species present in the permit area (personal communication, July 18, 1991, with Robin Jones, Nature Conservancy, Laramie). One state-listed species of concern, *Astragalus barrii*, is known to occur in the region, but none has been observed in the permit area.

3.5 Water Resources

3.5.1 Surface Water

The general hydrologic setting of the Rocky Butte mine area is illustrated on Figure 3-3. Most of the mine area is in the drainage of Caballo Creek. A small portion of the area drains northward into Dry Donkey Creek, a tributary to Donkey Creek. Both Caballo Creek and Donkey Creek are eastward-flowing tributaries to the Belle Fourche River, which joins the Cheyenne River in western South Dakota.

Tisdale Creek, a tributary to Caballo Creek, flows southward across the southwestern portion of the mine area. North Tisdale flows southward across the central portion of the mine area, joining Tisdale Creek about 3½ miles south of the Rocky Butte lease boundary. Gold Mine Draw, also a tributary to Tisdale Creek, drains the east-central part of the proposed mine area and joins Tisdale Creek about 3½ miles downstream from the mine boundary. Dry Donkey Creek drains the extreme eastern portion of the proposed mine area, joining Donkey Creek about 8 miles north of the mine area and about 10 miles east of Gillette, downstream from the Wyodak Mine. A large closed basin which does not contribute runoff to area streams is located in the existing lease area in parts of Sections 3, 4, 32 and 33 (Figure 3-3).

Into the Caballo Mine permit area downstream from the proposed Rocky Butte Mine, portions of Tisdale and North Tisdale Creeks have been removed by mining, and reservoirs have been constructed on both streams to keep flood waters out of Caballo Mine pit. Prior to mining activities at Caballo Mine, Tisdale Creek had a drainage area of about 19 square miles (sq mi), of which about 4.4 sq mi are downstream from the proposed Rocky Butte permit area. The premining drainage area of North Tisdale Creek was about 7 sq mi, of which about 3 sq mi are downstream from the Rocky Butte mine area. Gold Mine Draw, which has been affected to date only by the construction of the Caballo Mine rail loop, has a drainage area of about 10.5 sq mi, 6.5 of which are downstream from the Rocky Butte mine area. Only about 0.6 sq mi of the Dry Donkey Creek drainage area is within or upstream from the Rocky Butte mine area.

The drainage systems within the existing Rocky Butte lease area and the WRB tract consist of gently rolling topography. Streams within the proposed Rocky Butte permit area exhibit ephemeral streamflow; that is, they flow only in direct response to precipitation or snowmelt events. In general, the streams are typical for the region, and their flow events are closely reflective of precipitation patterns. Flow events of relatively small peak discharge can result from snowmelt during the late winter and early spring. Although peak discharges from such events are generally small, the duration and therefore percentage of annual runoff volume can be considerable. During the spring, general storms (both rain and snow) increase soil moisture, hence decreasing infiltration rates, and can result in both large runoff volumes and high peak discharges. General regional storms in May 1978 resulted in uncharacteristically large peak discharges for the area streams (Caballo Mine Permit Update, 1985). Brief, sometimes intense, summer thunderstorms can result in large peak flows, particularly on streams with small drainage areas. On the average, streams in this region experience from three to five separate runoff events in a typical year.

Surface water within the region surrounding the proposed and existing lease areas is commonly used for wildlife, stock watering and limited irrigation. Irrigation in the vicinity of the Rocky Butte area is necessarily limited by the topography and the ephemeral characteristics of streamflow to small areas adjacent to stream channels. No irrigation facilities exist on the area to be disturbed by the Rocky Butte Mine.

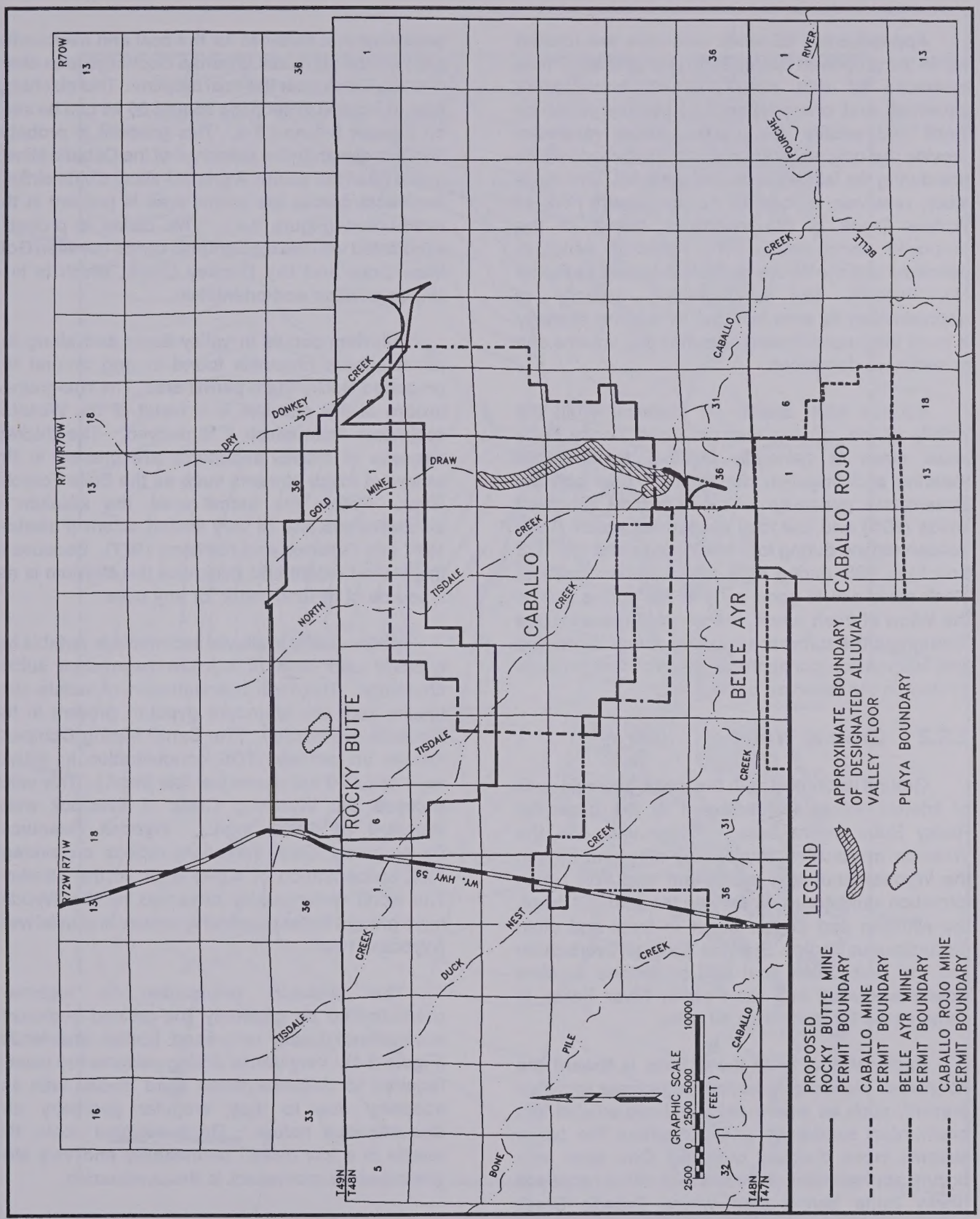


Figure 3-3. Surface Water Features in Vicinity of Proposed Rocky Butte Mine

Approximately 35 stock reservoirs are located within the proposed Rocky Butte permit area. These reservoirs fill with runoff derived from spring snowmelt and precipitation and provide water for stock and wildlife use. Often, these reservoirs provide the only water sources for stock and wildlife use during the late summer and early fall. One large stock reservoir is located on the North Fork of Tisdale Creek in the northwest corner of the proposed permit area. The reservoir, which is permitted with the Wyoming State Engineer as Permit No. P6465R, has a permitted capacity of approximately 82 acre-feet, but its existing capacity is most likely considerably less than this volume due to sediment deposition.

Surface water quality for streams within the vicinity of the existing and proposed Rocky Butte lease areas is generally suitable for livestock watering and irrigation during most flow periods. Streamflows generally exhibit high total dissolved solids (TDS) and low total suspended solids (TSS) concentrations during low-flow periods and low TDS and high TSS during high flow. Water quality in stock reservoirs is good early in the spring due to the inflow of fresh runoff, but generally deteriorates throughout the summer as surface runoff decreases and evaporation concentrates the dissolved mineral content in the reservoir pools.

3.5.2 Ground Water

Ground water occurs in five major geologic units of interest within and adjacent to the proposed Rocky Butte permit area. These units are the Wasatch overburden, Quaternary alluvium, clinker, the Wyodak-Anderson coal seam and Fort Union formation sandstones underlying the coal. Of these, the alluvium and clinker occur in local and often discontinuous bodies. Both the Wasatch overburden and the Fort Union coal and sandstone aquifers extend westward into the Powder River Basin, in some cases for more than 50 miles.

Regional flow in all these units is toward the northwest. However, local discharge areas are often present, such as where streams have eroded into overburden sandstone units or where the larger streams cross the coal outcrop. One such area occurs approximately 5 miles south of the proposed Rocky Butte permit area where Caballo Creek crosses the coal outcrop. The premining potentiometric surfaces for the coal and overburden both exhibit gradients toward a discharge area along Caballo Creek near the coal cropline. This discharge area is located in sections 35 and 36 as can be seen on Figures 3-4 and 3-5. This gradient is probably now increased by the presence of the Caballo Mine's active pit to the south. A ground-water divide striking northwest across the permit area is present in the overburden (Figure 3-4). This divide is probably associated with the topographic divide between Gold Mine Draw and Dry Donkey Creek, which is in a similar position and orientation.

Alluvium occurs in valley floors and along the minor stream channels found in and around the proposed Rocky Butte permit area. The fine-grained texture of this alluvium is a result of the Wasatch sediments from which it is derived. The thickest deposits of alluvial sediments are present in the valleys of major streams such as the Belle Fourche River. Within the permit area, the alluvium is discontinuous and of very limited extent (Fullerton, 1977 and Fullerton and Kirkham, 1977). Because of this limited extent and thickness the alluvium is not a source of ground-water for any uses.

Water quality in alluvial sediments is variable but typically poor and of calcium-magnesium sulfate chemistry. This high concentration of sulfate salts results from the abundant gypsum present in the Wasatch overburden. The Carter Mining Company reports an average TDS concentration in alluvial wells of 6,990 milligrams per liter (mg/L). This value exceeds the Wyoming Class III livestock water standard of 5,000 mg/L. Wyodak Resources Development Corp. (Wyodak) reports an average TDS concentration of 4,340 mg/L in the alluvium. The worst water quality observed by the Wyodak mine ground water monitoring occurs in alluvial wells (Wyodak, 1990).

The Wasatch overburden is regionally characterized by generally fine-grained sediments interspersed locally with sand bodies and lenses (Figure 3-1). Very dense drilling patterns are usually required to delineate these sand bodies with any accuracy due to their irregular geometry and discontinuous nature. On a regional scale, this results in a low overall permeability and very slow ground-water movement in the overburden.

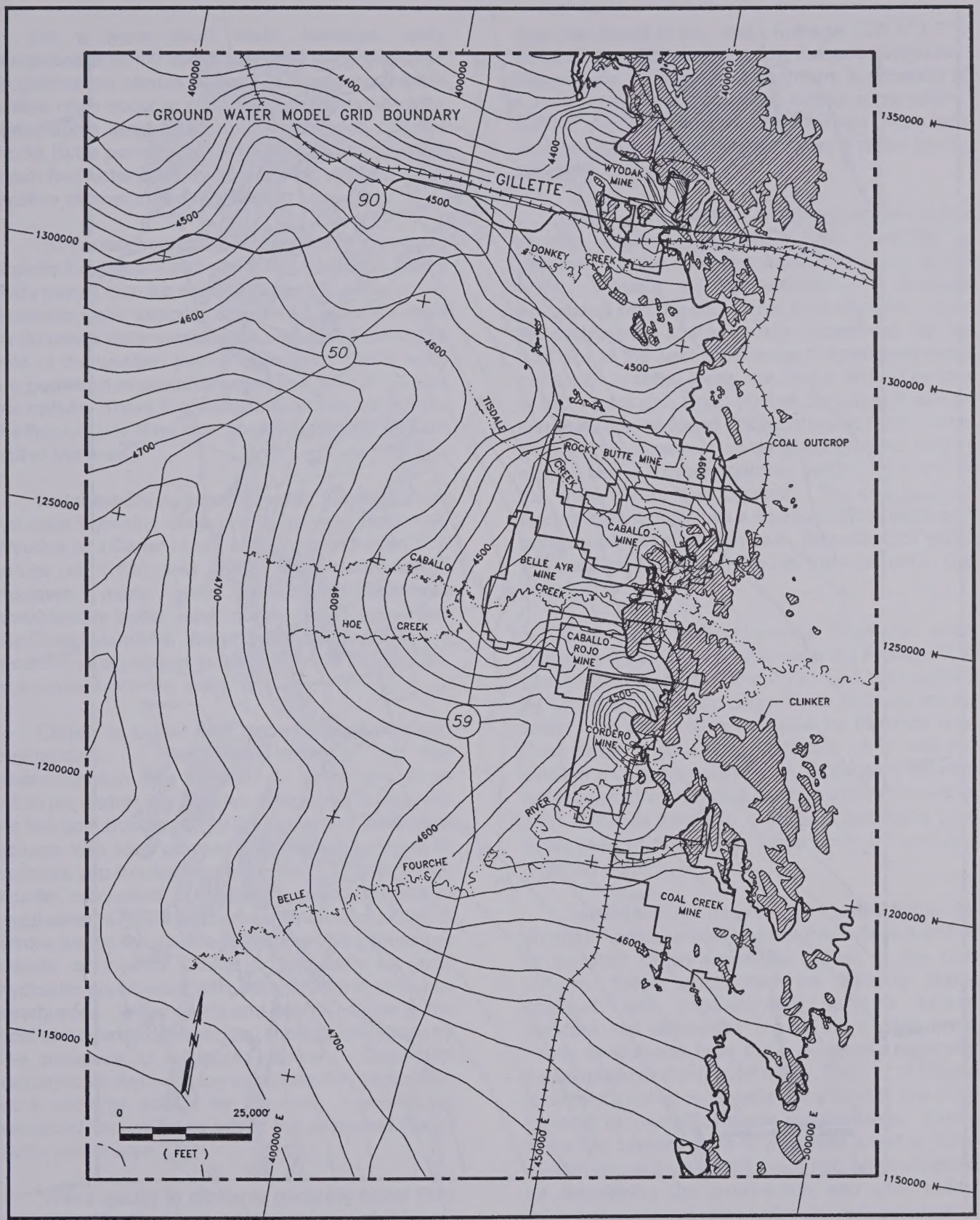


Figure 3-4. Regional Premining Static Water Levels in the Wasatch Overburden

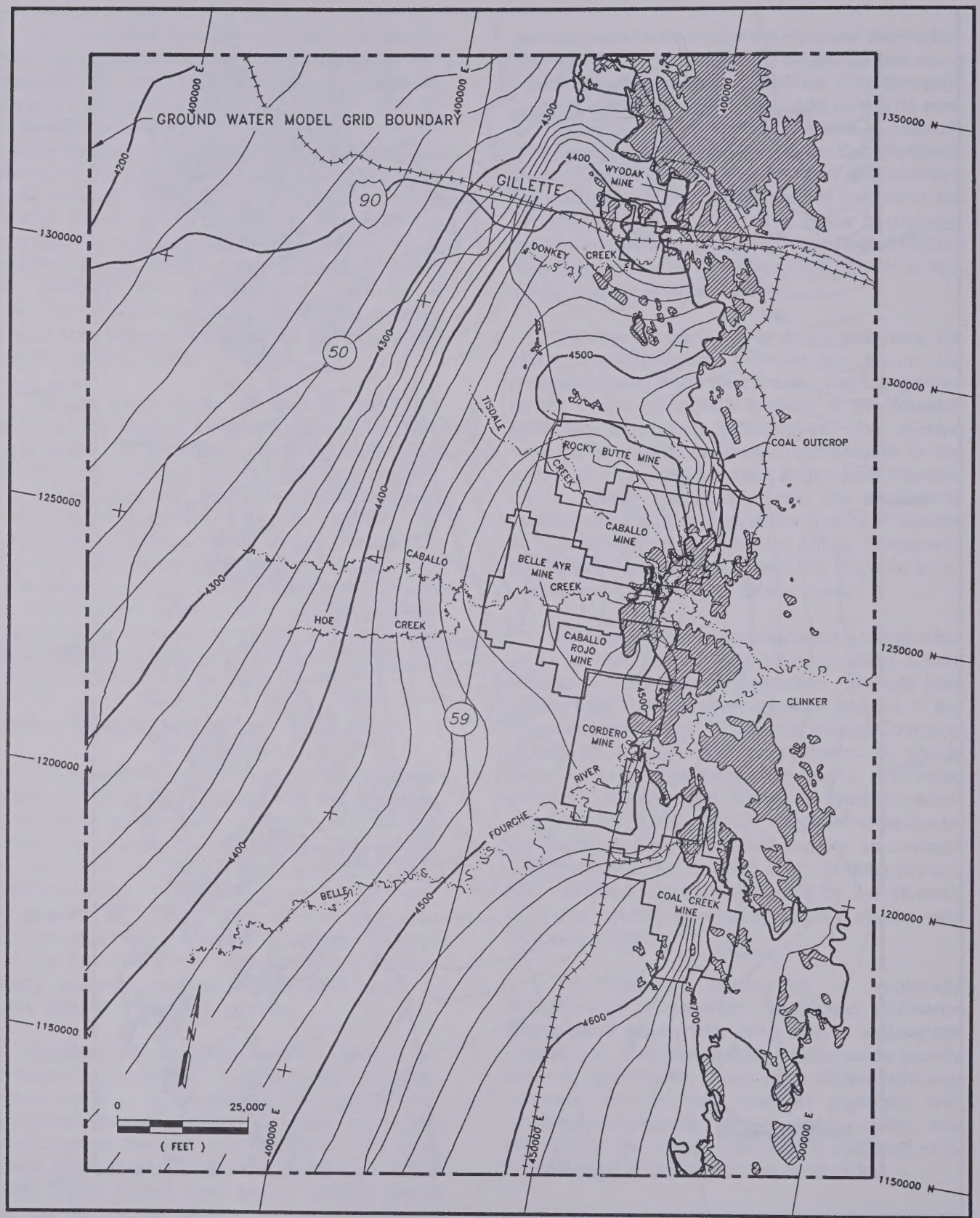


Figure 3-5. Regional Premining Static Water Level in the Wyodak-Anderson Coal Seam

On a more local scale, however, wells completed in sandy zones can produce in excess of 25 gallons per minute of good quality water. Sand bodies often occur at two or more elevations in the stratigraphic sequence of the overburden. In the Rocky Butte permit area, this situation often results in perched water-table zones overlying semi-confined aquifers deeper in the overburden sequence.

The Wasatch sands described above have been exploited regionally and within the proposed Rocky Butte permit area for stock water and in some cases domestic water supplies. Several such wells used for domestic water supplies are completed within one mile of the western permit boundary. These wells are permitted to produce between 2 and 20 gallons per minute. There is considerable saturated sand in the Rocky Butte Mine area, particularly in the western half of the area.

Water quality in the overburden generally does not meet Wyoming Class I drinking water standards. Wyodak and Carter report average overburden TDS values of 1,630 and 2,960 mg/L, respectively. However, many wells produce water with considerably better water quality which does meet the Class I standard. Water chemistry tends to be of a calcium-magnesium sulfate type, but bicarbonate is abundant in many wells.

Clinker is baked and partially fused Wasatch overburden. The heat required for this metamorphism was supplied in prehistoric times when the underlying Wyodak-Anderson coal burned. As the coal burned, 80 to 90 percent of its original volume was lost, causing the overlying clinker to collapse into the ensuing void. A highly permeable aquifer composed of coarse, resistant fragments resulted from these processes. Wells completed in clinker are often capable of yielding 250 gallons per minute or more. Clinker is frequently in good hydraulic connection with both coal and unbaked overburden. Water levels and flow directions in the coal and overburden are often strongly influenced by the presence of saturated clinker. Regionally, saturated clinker is an important aquifer, particularly as a recharge source for the coal. However, no saturated clinker exists within the proposed Rocky Butte permit area.

Water quality in clinker is generally better than is reported for the overburden and somewhat worse than that found in the coal. Average TDS of 1,710 and 3,830 mg/L are reported by Carter and Wyodak, respectively. Clinker water chemistry is generally of a calcium-magnesium-sodium sulfate composition. Sulfate concentrations in particular are often high enough to exceed Wyoming's Class II water quality standard for irrigation.

The Wyodak-Anderson coal seam exhibits highly variable aquifer properties. This variability is governed by the extensive fracturing typical of the unit. Virtually all permeability and porosity associated with the coal arises from fractures. Near the outcrop, the coal is usually unconfined. As the coal dips to the west, it becomes progressively more confined. In some areas, the coal is divided by one or more partings. Up to 70 feet of parting in one or two splits can be found in the proposed Rocky Butte permit area. However, some areas have no parting and 15 feet is a more common parting thickness in the areas where it is present. The coal is used throughout the region as a source of stock water and occasionally for domestic use. Several stock water wells are currently permitted in the coal within the permit area.

Coal water quality usually does not meet Wyoming Class I or Class II standards. Average TDS concentrations of 1,210 and 2,120 mg/L are reported by Carter and Wyodak, respectively. In most cases, water from coal wells is suitable for livestock use. Coal water chemistry is generally of a sodium-calcium carbonate-sulfate type. In general, the coal water quality trends from a calcium sulfate type water near recharge zones to a sodium carbonate type water away from recharge areas where the coal is a confined aquifer.

Several sandstone units are located below the Wyodak-Anderson coal seam in the Tullock member of the Fort Union formation. West of the coal outcrop, these sandstones are typically highly confined, with potentiometric surfaces several hundred feet above the top of the aquifer zone. These sandstones have been developed regionally for domestic and industrial uses. The City of Gillette is currently using eight wells completed in this zone to meet its municipal water requirements. Rocky Butte has backup plans to complete a well in these sandstones in the unlikely event that water obtained by dewatering the overburden and coal during mining cannot meet mine water usage requirements.

Water quality in the Fort Union sands often meets Wyoming Class I drinking water standards. TDS concentrations less than 500 mg/L are commonly reported. Class I individual constituent standards are also seldom exceeded.

Within 3 miles of the proposed Rocky Butte permit area there are 222 water wells, excluding wells used solely for hydrologic monitoring. Of these, 96 wells (43 percent) are completed in the overburden, 65 (29 percent) are completed in sandstone units below the coal, 22 (10 percent) are completed in the Wyodak-Anderson coal seam, 16 (7 percent) are completed in both the overburden and the underburden, and 2 wells (1 percent) are completed in both coal and overburden. The remainder have unknown completion details.

3.6 Alluvial Valley Floors

Tisdale Creek, North Tisdale Creek, Gold Mine Draw and Dry Donkey Creek have all been studied to see if they exhibit alluvial valley floor characteristics as defined by Wyoming and federal surface coal mine regulations. The designation of a valley as an alluvial valley floor (AVF) by regulatory agencies has significant bearing on the requirements of the mine and reclamation plans in mine permitting. The lower reaches of Tisdale and North Tisdale Creeks and Gold Mine Draw were studied by The Carter Mining Company within the Caballo Mine in the early 1980s. At approximately the same time, TESI independently conducted AVF studies on the upper reaches of these streams within the Rocky Butte and WRB tracts. The TESI studies were described in the mine permit application that was submitted for the Rocky Butte Mine in 1984. TESI subsequently withdrew this permit application, and no AVF designations were made for the area of the Rocky Butte and WRB tracts. A preliminary AVF report of Dry Donkey Creek was recently submitted to the Wyoming DEQ/LQD by NWR as part of the permitting studies now underway for the Rocky Butte Mine.

The Caballo Mine studies of the AVF characteristics of Tisdale and North Tisdale Creeks and Gold Mine Draw were reported in the mine permit 433-T1 application. From these studies the OSM and Wyoming DEQ/LQD made the following AVF designations:

- Tisdale Creek is not an AVF west of Section 25, T.48N., R.71W., in the Caballo Mine permit area.
- North Tisdale Creek is not an AVF in the Caballo Mine area.
- The mouth of Tisdale Creek at its confluence with Caballo Creek is an AVF.
- Downstream Tisdale Creek (from the west boundary of Section 25 downstream to the AVF reach identified under no. 3 above) was not declared.
- Gold Mine Draw was declared an AVF downstream of the northern border of Section 13, T.48N., R.71W., in the Caballo Mine. Upstream of this border it was declared a non-AVF.

In the decision document for the approval of the Caballo Mine permit 433-T1, the Wyoming DEQ/LQD stated that the valley floor of Gold Mine Draw within the northern three-quarters of Section 13 is significant to farming and is therefore prohibited from mining.

Based on the AVF investigations of the two mining companies, there appear to be no distinguishing differences between the upper reaches of Tisdale Creek, North Tisdale Creek and Gold Mine Draw within the Rocky Butte and WRB tracts and the lower reaches of these same streams in the non-AVF reaches of the Caballo Mine. Throughout both areas these three stream valleys contain only intermittent alluvial deposits and the stream terraces are poorly defined. All three stream channels are largely developed in bedrock. Except for the channel floors themselves and along the fringes of channel impoundments, there is no enhanced vegetation or other evidence of subirrigation along the three stream valleys outside of the declared AVF reaches. Within the proposed Rocky Butte permit area both Tisdale Creek and North Tisdale Creek and some of their larger tributaries flow across broad areas of flat terrain. It is doubtful that any reach of Tisdale Creek, North Tisdale Creek or Gold Mine Draw in the Rocky Butte permit area meets the statutory definition of an AVF.

Dry Donkey Creek east and north of the Rocky Butte Mine permit area (Figure 3-3) probably does not meet the statutory definition of an AVF along certain reaches. The preliminary AVF study of this valley shows a well defined body of stream laid

deposits that is generally 150 to 200 feet wide. Based on available monitoring well data, however, the deposits are usually dry. Eight channel impoundments collectively store approximately 43 acre-feet of water in the reach of the stream between the north boundary of Section 8, T.48N., R.70W. and the SE1/4 Section 31, T.49N., R.70W. With the exception of a reach of the channel some 1,000 feet long in the E1/2 Section 6, T.48N., R.70W., riparian vegetation was found only around the fringes of several of the channel impoundments. The riparian vegetation in Section 6 is sustained by ground water seepage originating to the east of the Dry Donkey Creek valley floor.

A distinguishing characteristic of the Dry Donkey Creek valley is the presence of six large spreader dikes that span the valley floor in Section 31, T.49N., R.70W. The dikes were constructed in 1973 to trap and spread streamflow across approximately 80 acres of grass and alfalfa raised on the valley floor. The AVF investigation by NWR indicates that the agricultural productivity of Dry Donkey Creek near the proposed Rocky Butte Mine permit area is not significantly enhanced by flood irrigation or by natural subirrigation. At the time of this writing the DEQ/LQD has not yet commented on the preliminary AVF investigation of Dry Donkey Creek. It seems unlikely, based on similarities with other declared non-AVF areas, that any portion of the valley will be declared an AVF at least within the reach included in the AVF investigation.

Between 1963 and 1968 a system of impoundments and spreader dikes was constructed along lower Gold Mine Draw in Section 13 south of the Rocky Butte lease. This system has been used to irrigate approximately 90 acres of grass and alfalfa (CDM, 1984).

3.7 Fish and Wildlife

3.7.1 Fisheries

Approximately 35 ponds (about 100 acres), and numerous creeks (e.g., Tisdale Creek and Gold Mine Draw) and unnamed drainages occur on the permit area; however, no known fisheries occur in these waters. Some warm-water species (e.g., green sunfish [*Lepomis cyanellus*]) and non-game species (e.g., plains killifish [*Fundulus sciadulus*], fathead minnow [*Pimephales promelas*]) may be present in deeper stock ponds located on and immediately adjacent to the area; however, no population data or fisherman use statistics are available.

3.7.2 Big Game Animals

Three big game species occur on the proposed permit area, pronghorn antelope (*Antilocapra americana*); mule deer (*Odocoileus hemionus*); and white-tailed deer (*O. virginianus*). Pronghorn antelope are the most abundant species. Figures 3-6 and 3-7 show the areas of occupied habitat for the three species.

Pronghorn antelope are found yearlong in the proposed permit area and have been observed in all vegetation types, including disturbed areas (e.g., oil pumping stations). The majority of animals observed during aerial and ground surveys occurred in sagebrush habitats (Figure 3-2); however, pronghorn also congregated on hay fields after cutting (unpublished data, Mariah 1991).

All pronghorn on the permit area belong to the Hilight herd (WGFD, 1991a) (Figure 3-6). Those animals in the two mile buffer around the permit area west of State Highway 59 are part of the Pumpkin Buttes herd. The permit area is all within antelope hunt area 24; areas west of State Highway 59 are entirely within hunt area 23.

The WGFD population objective for the Hilight herd is 11,000 animals, and the estimated end-of-year population in 1990 was approximately 10,900 (WGFD, 1991a). While the current pronghorn population is slightly under objective, the estimated 1991 population (based on trend counts) is approximately 12,000 animals, 1,000 animals above objective. During the 1990 pronghorn season, harvest (1,119 animals) was below WGFD objectives for the herd.

The population objective for the Pumpkin Buttes herd is 18,000 animals. Current population estimates for the herd indicate approximately 22,600 animals, well above the WGFD objective (WGFD, 1991a). This increased population is likely the result of several mild winters. During 1990, pronghorn harvest (2,368 animals) was below WGFD objectives.

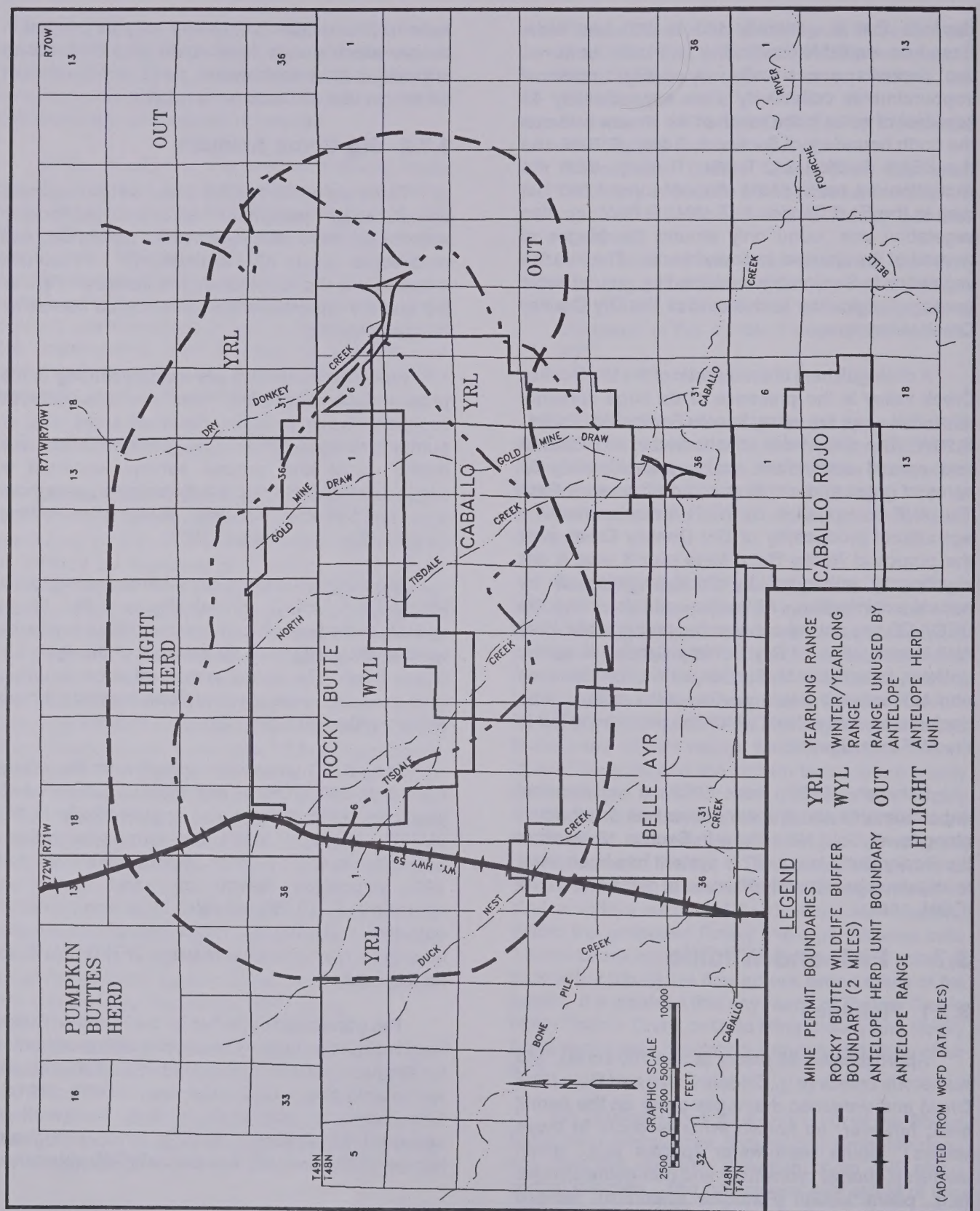


Figure 3-6. Pronghorn Antelope Ranges On and Near the Proposed Rocky Butte Mine

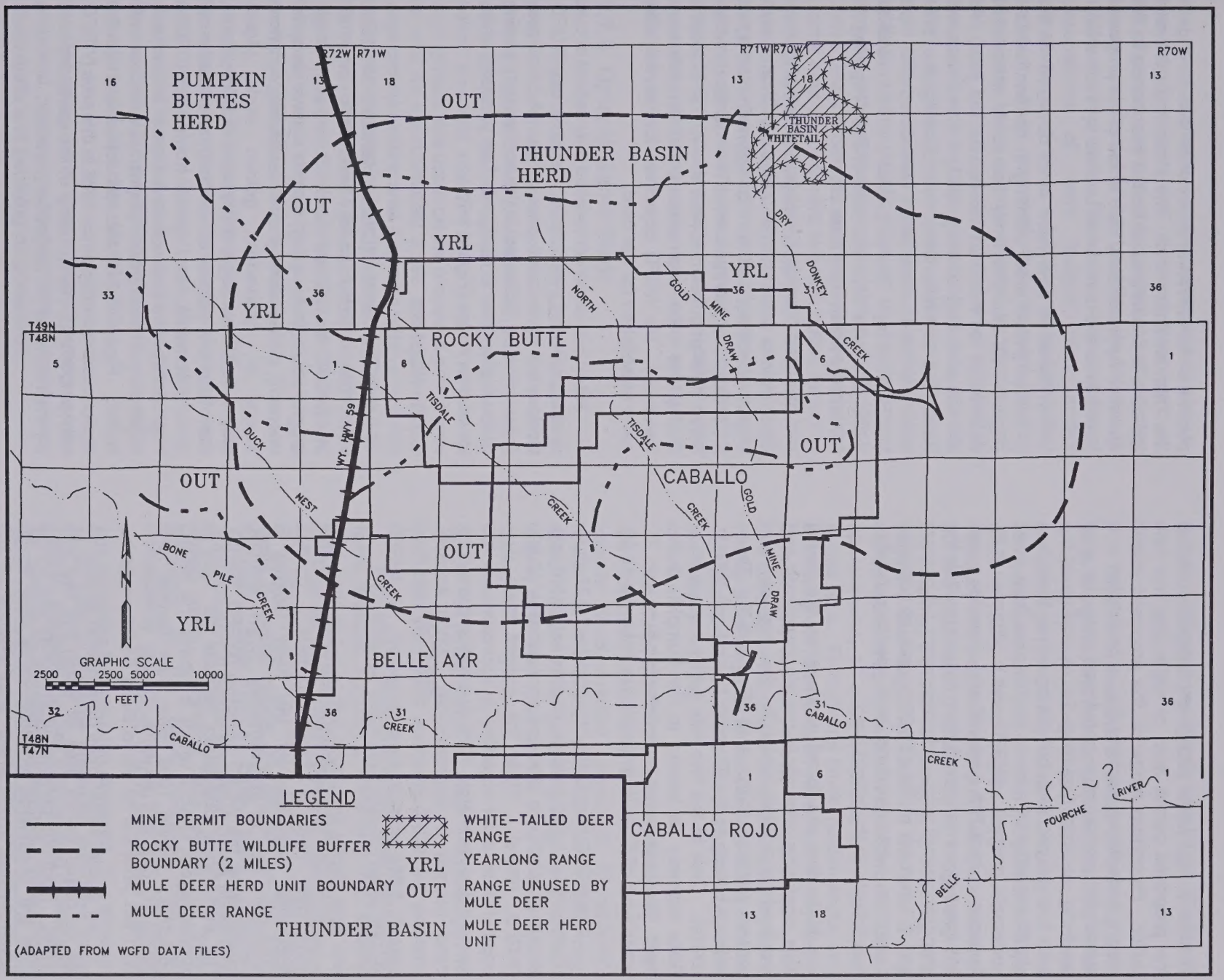


Figure 3-7. Deer Range On and Near the Proposed Rocky Butte Mine

No crucial winter pronghorn habitat occurs on the proposed permit area or within the two mile buffer. Pronghorn range on the proposed permit area is considered yearlong (i.e., a population or a substantial portion of a population uses the area yearlong) or winter/yearlong (i.e., a portion of the area is used yearlong, but during winter there is a significant influx of animals to this area from other seasonal ranges) (WGFD nd.) (Figure 3-6). Approximately 8,762 acres of winter/yearlong and 885 acres of yearlong pronghorn range are within the proposed permit area. This represents 1.3 percent and 0.1 percent of the 650,200 acres of occupied pronghorn winter/yearlong and yearlong habitat, respectively, in the Hilight herd.

Mule deer are found yearlong on the permit area, occurring primarily in the big sagebrush and cropland vegetation types in the northern and eastern portions of the area (Figure 3-7). These animals belong to the Thunder Basin herd (WGFD, 1991a). Deer in the two-mile buffer zone west of State Highway 59 belong to the Pumpkin Buttes herd. The permit area is contained in hunt area 21; areas west of State Highway 59 are in hunt area 20.

The WGFD population objective for the Thunder Basin herd is 13,000 animals, and the estimated end-of-year population in 1990 was approximately 12,600 (WGFD, 1991a). While the current mule deer population is under objective by approximately 400 animals, the estimated 1991 population (based on trend counts) is approximately 13,000 animals, precisely the WGFD objective. During the 1990 deer season, 1,063 animals were harvested. No WGFD objectives for harvest have been established.

The population objective for the Pumpkin Buttes mule deer herd is 11,000 animals. Current population estimates for the herd indicate a population size of approximately 10,970 animals, essentially at the WGFD objective (WGFD, 1991a). The end-of-year population estimate for 1991 is approximately 11,450, which is above the WGFD objective. During 1990 mule deer harvest (983 animals) was below WGFD objectives.

No crucial winter mule deer habitat occurs on the proposed permit area or within the two mile buffer. Northern portions of the proposed permit area are considered yearlong mule deer range (approximately 6,020 acres) and account for 0.3 percent of the 1,968,000 acres of mule deer range in the Thunder Basin herd. The remaining portion of the area is considered of limited importance to the species. Approximately 823 acres of the proposed permit area are considered unused by mule deer.

White-tailed deer have been observed on the proposed permit area, primarily in riparian habitats (Figure 3-2), and it is likely that some white-tailed deer occur on the area throughout the year. All animals occurring on the proposed permit area and within the two-mile buffer surrounding the area belong to the Thunder Basin white-tailed deer herd (WGFD, 1991a). The proposed permit area is all within hunt area 21; areas west of State Highway 59 fall entirely within hunt area 20.

The WGFD population objective for the Thunder Basin herd is 1,750 animals, and the estimated end-of-year population in 1990 was approximately 1,800 (WGFD, 1991a), so the current Thunder Basin white-tailed deer population is near the WGFD objective. During the 1990 deer season, 253 animals were harvested. No WGFD objectives for harvest have been established for the herd.

No crucial winter white-tailed deer habitat occurs on the proposed permit area, nor does any WGFD-designated white-tailed deer range. A small area (approximately 195 acres) in the northeastern portion of the buffer zone is designated as yearlong white-tailed deer range (Figure 3-7).

3.7.3 Raptors

Northern harrier (*Circus cyaneus*), red-tailed hawk (*Buteo jamaicensis*), Swainson's hawk (*B. swainsoni*), ferruginous hawk (*B. regalis*), rough-legged hawk (*B. lagopus*), Cooper's hawk (*Accipiter cooperii*), prairie falcon (*Falco mexicanus*), American kestrel (*F. sparverius*), golden eagle (*Aquila chrysaetos*), bald eagle (*Haliaeetus leucocephalus*), burrowing owl (*Athene cunicularia*), short-eared owl (*Asio flammeus*), and great horned owl (*Bubo virginianus*) have been observed on or immediately adjacent to the proposed permit area and two-mile buffer. Figure 3-8 shows all active and inactive raptor nests recorded since 1986 in this area (WGFD, 1991b; USFWS, 1991); many of the nests depicted on the map may no longer be present.

Five active raptor nests (three Swainson's hawk, two red-tailed hawk, one unknown) were found on the proposed permit area and adjacent buffer during surveys conducted in 1991. All nests located in 1991 were tree nests. Based on a large number of observations of newly fledged birds and/or observations of birds exhibiting nesting/breeding behavior, it is assumed that northern harrier, ferruginous hawk, American kestrel, short-eared owl, and great horned owl also nested on or adjacent to the permit area in 1991 (unpublished data, Mariah, 1991). Additional raptor nesting data was obtained from Ron Starkey, (personal communication, USFWS, 1991), WGFD (1991b), BLM (1985), and Larry Gerard (personal communication, BLM, 1991). These data indicate 30 nests occur on the proposed permit area and adjacent two-mile buffer, including nesting by ferruginous hawk (ground, cliff, and tree nests), golden eagle (cliff and tree nests), great horned owl (cavity and tree nests), short-eared owl (ground nest), and burrowing owl (burrow nests) (Figure 3-8). Golden eagle and red-tailed hawk apparently utilize the same nests on the area during different years.

3.7.4 Upland Game Birds

Three species of upland game birds, sage grouse (*Centrocercus urophasianus*), sharp-tailed grouse (*Tympanuchus phasianellus*), and mourning dove (*Zenaida macroura*), occur on the proposed permit area and adjacent buffer area. Two historic sage grouse leks occur on the proposed permit area as well as approximately 5,996 acres of potential sage grouse nesting area (i.e., area within a two-mile radius surrounding historic lek centers) (Figure 3-8). Numerous observations of sage grouse broods in the permit area were made during 1991, indicating that the area is also utilized by the species for rearing young (unpublished data, Mariah, 1991).

No WGFD observations of sharp-tailed grouse have been recorded for the proposed permit area (WGFD, 1991b). However, one observation of a sharp-tailed grouse brood was made during 1991 west of State Highway 59 within the two-mile buffer zone (unpublished data, Mariah, 1991).

Mourning doves were observed throughout the proposed permit area during 1991, primarily near shelterbelts and perching on powerlines.

3.7.5 Migratory Birds of High Federal Interest

Table 3-3 presents a listing of the migratory birds of high federal interest (MBHFI) that may occur on the proposed permit area. Ferruginous hawk, golden eagle, prairie falcon, and burrowing owl were all observed in the area in 1991 (unpublished data, Mariah, 1991). Bald eagles were observed in February 1988 approximately 0.5 mile southeast of the two-mile buffer (WGFD 1991b), suggesting that the area may be used for foraging by wintering bald eagles. Bald eagles present on the area during winter are likely from the Belle Fourche roost located approximately 10 miles southeast of the proposed permit area. Ferruginous hawk, golden eagle, and burrowing owl have all been observed nesting on the area or within the two-mile buffer, and as such also use the area for hunting. Prairie falcon nesting in the vicinity is unlikely due to the absence of appropriate cliff habitat; however, the species apparently uses the area for hunting.

Additional MBHFI that may sporadically utilize the proposed permit area and surrounding buffer include double-crested cormorant, Richardson's merlin, sandhill crane, mountain plover, and long-billed curlew. White pelican, peregrine falcon, and osprey may also feed on the area in some years during their migrations.

3.7.6 Threatened and Endangered Species

Bald eagle, peregrine falcon, and black-footed ferret (*Mustela nigripes*) are the only T&E species that may occur in the proposed permit area and adjacent two-mile buffer (personal communication, Ron Starkey, USFWS, 1991). No known bald eagle nests or winter roosts are present on the area; however, bald eagle have been observed approximately 0.5 mile southeast of the buffer area during winter. Migrating bald eagles and those wintering at the Belle Fourche roost may occasionally use the area for foraging. No known peregrine falcon nests occur on the area, nor have any peregrine falcons been observed. The absence of tall cliffs in the area precludes peregrine falcon nesting, although the area may be used occasionally for hunting by migrating peregrines. No confirmed black-footed ferret sightings have been recorded for

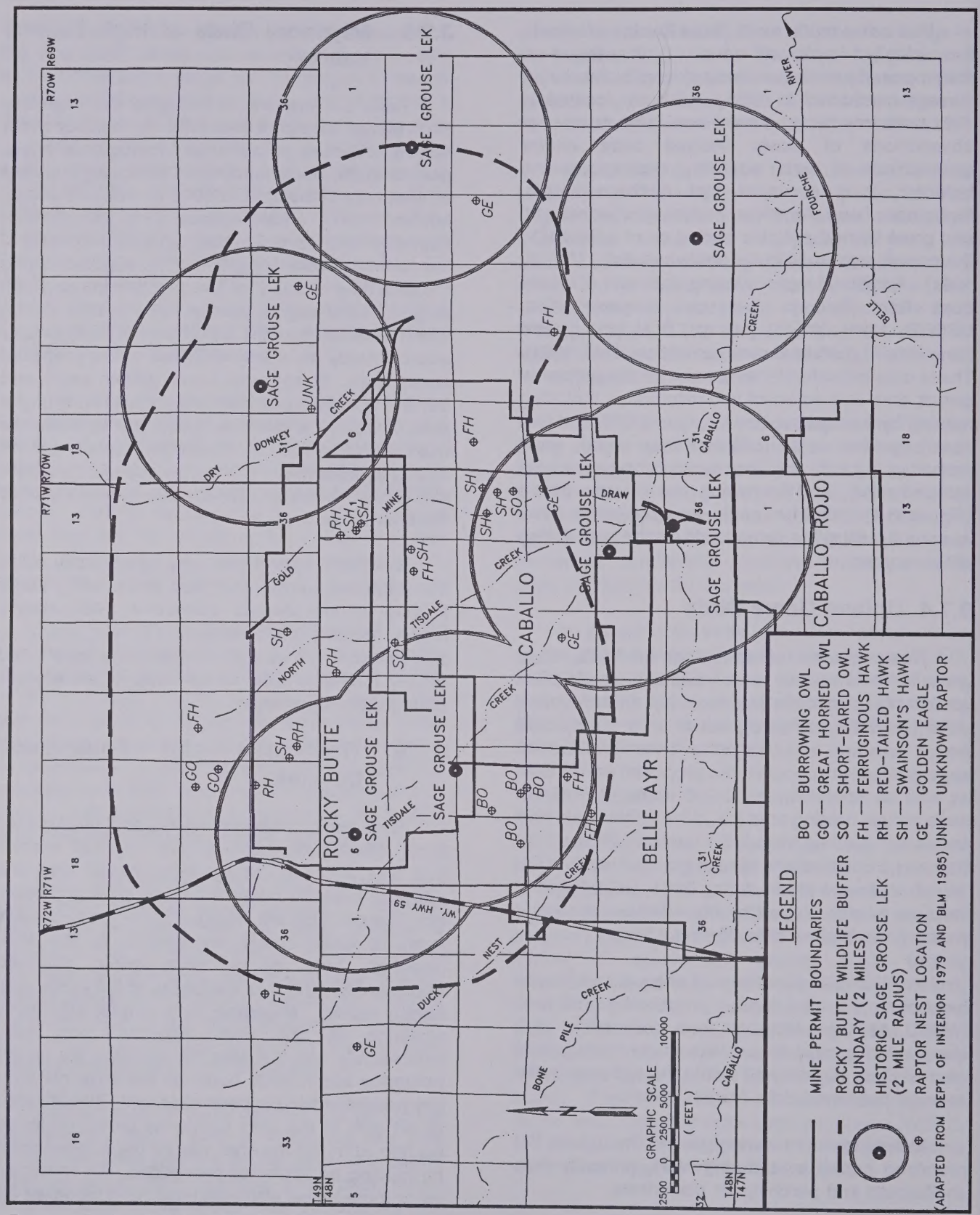


Figure 3-8. Raptor Nests and Sage Grouse Leks On and Near the Proposed Rocky Butte Mine

the permit area. Since no prairie dog colonies were found during 1991 surveys of the proposed permit area and surrounding two-mile buffer, the presence of black-footed ferret on the area is highly unlikely.

Table 3-3 Migratory Birds of High Federal Interest in Northeast Wyoming and Expected Occurrence On or Near the Proposed Rocky Butte Mine, Campbell County, Wyoming, 1991.

Common Name	Scientific Name	Wyoming Seasonal Status/Breeding Records in NE Wyoming[1]	Sighting Records[2]	Expected Occurrence in and Adjacent to the Rocky Butte Permit area
White Pelican	*Pelecanus erythrorhynchos*	Summer/nonbreeder	None	uncommon/migrant
Double-crested cormorant	*Phalacrocoraxauritus*	Summer/breeder	None	uncommon/breeder
Canvasback	*Aythya valisineria*	Summer/nonbreeder	None	rare/migrant
Ferruginous hawk	*Buteo regalis*	Resident/breeder	Mariah/WGFD/BAMP/CCMP	common/breeder
Golden eagle	*Aquila chrysaetos*	Resident/breeder	Mariah/WGFD/BAMP/CCMP	common/breeder
Bald eagle	*Haliaeetus leucocephalus*	Resident/nonbreeder	WGFD/BAMP/CCMP	uncommon/winter
Osprey	*Pandion haliaetus*	Resident/nonbreeder	None	uncommon/migrant
Prairie falcon	*Falco mexicanus*	Resident/breeder	Mariah/WGFD/CCMP	uncommon/breeder
Peregrin falcon	*Falco perigrinus*	Resident/nonbreeder	None	rare/migrant
Richardson's merlin	*Falco columbarius*	Resident/breeder	WGFD	uncommon/breeder
Whooping crane	*Grus americana*	Never recorded	None	very rare/migrant
Sandhill crane	*Grus canadensis*	Summer/breeder	CCMP	uncommon/migrant
Mountain plover	*Eupoda montana*	Never recorded	None	rare/breeder
Long-billed curlew	*Numenius americanus*	Summer/nonbreeder	BAMP	uncommon/migrant
Burrowing owl	*Athene cuniculara*	Summer/breeder	Mariah/WGF	uncommon/breeder
Lewis' woodpecker	*Asyndesmus lewis*	Summer/nonbreeder	None	rare/migrant
Dickcissel	*Spiza americana*	Never recorded	None	rare/migrant

[1] Compiled from Oakleaf et al. (1991); includes north and central Campbell County, northwest Weston County, and west Crook County.

[2] Mariah: 1991 field investigations
WGFD: Observation records
BAMP: Belle Ayr mine permit
CCMP: Carter Caballo mine permit

A Wyoming Natural Diversity Data Base search for State sensitive wildlife species on the permit area and adjacent townships revealed no reports of occurrences (personal communication, Robin Jones, Nature Conservancy, 1991). The WGFD (personal communication, Sharon Ritter, 1991) has identified

priority bird species that may be present on or near the proposed mine site. These include upland sandpiper (*Bartramia longicauda*), burrowing owl, ferruginous hawk, and long-billed curlew. The WGFD also identified mountain plover (*Charadrius montanus*), a candidate species for T&E listing, as potentially occurring on the site. Burrowing owl, upland sandpiper and ferruginous hawk were observed on the area in 1991 (unpublished data, Mariah, 1991); and long-billed curlew are known to occur in the Campbell County area (Oakleaf et. al., 1990). Mountain plover has never been recorded in the area (Table 3-3).

3.7.7 Other Species

Five species of predator and/or predator sign were observed on the proposed permit area and adjacent two-mile buffer during 1991 (unpublished data, Mariah, 1991). These species were coyote (*Canis latrans*); red fox (*Vulpes vulpes*), bobcat (*Felis rufus*), badger (*Taxidea taxus*), and striped skunk (*Mephitis mephitis*). Other predator/furbearing species that may occasionally occur on the area include grey fox (*Urocyon cinereoargenteus*), raccoon (*Procyon lotor*), ermine (*Mustela erminea*), long-tailed weasel (*M. frenata*), and eastern spotted skunk (*Spilogale putorius*).

Three lagomorph species--desert cottontail rabbit (*Sylvilagus audoboni*), whitetailed jackrabbit (*Lepus townsendi*), and blacktailed jack rabbit (*L. californicus*)--were observed on the proposed permit area during 1991 (unpublished data, Mariah, 1991). Other small mammals commonly occurring on the area include deer mouse (*Peromyscus maniculatus*), thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*), and vole (*Microtus* spp.).

Common nongame birds on the area include horned lark (*Eremophila alpestris*), western meadow lark (*Sturnella neglecta*), lark bunting (*Calamospiza melanocorys*), killdeer (*Charadrius vociferus*), kingbird (*Tyrannus* spp.), loggerhead shrike (*Lanius ludovicianus*), and American robin (*Turdus migratorius*).

Common nesting waterfowl on the area include mallard (*Anas platyrhynchos*), gadwall (*A. strepa*), and American widgeon (*A. americana*). Canada geese (*Brant canadensis*) were also observed feeding in grain fields on the area.

3.8 Historical, Archaeological, and Paleontological Resources

The Eastern Powder River Basin is associated with an important prehistoric and historic past. The area's archaeological record has been documented through surveys and excavations, while the historic record has been further documented by written records since 1850. In addition, Tertiary rock formations and overlying Quaternary deposits have potential to contain important paleontological remains.

Native American consultation is required by the Archaeological Resources Protection Act and the American Indian Religious Freedom Act. During scoping for this EIS, comments were solicited from the Bureau of Indian Affairs as well as from representatives of the Northern Arapahoe, Northern Cheyenne, Oglala Sioux and Shoshoni Tribes. If any comments are received from these sources they will be included, together with responses, in the final EIS.

3.8.1 Archaeological Resources

The area around Gillette appears to have been inhabited by aboriginal hunting and gathering peoples for over 10,000 years. The known archaeological record indicates occupation of this portion of the Powder River Basin beginning in the Paleoindian period and continuing until the Historic period, when the Plains Indians were relocated by the encroaching Euroamerican population to reservations outside the Powder River Basin.

The lengthy cultural history of the Powder River Basin has been evidenced through numerous archaeological surveys in the last 15 years within the Rocky Butte permit area.

Major field work was conducted within the Rocky Butte lease area by Science Applications, Inc. in 1981 for Hampshire Energy (Southward and Friedman 1981); by Powers Elevation in 1981 for Environmental Research and Technology, Inc. (Persinger et al., 1981); by Powers in 1983 for Texas Energy Services, Inc. (Floodman and Friedman, 1983); and by Mariah in 1991 for NWR (1991, in prep.). Additional survey and mitigation work was carried out for The Carter Mining Company in the

adjacent Caballo Mine lease by the Office of the Wyoming State Archaeologist between 1975 and 1981 (Eckles et al., 1980; Hauff and Eckles, 1982) and by Larson-Tibesar Associates in 1983 (Tibesar et al. 1983).

Class I cultural resource file search results provided by the State Historic Preservation Office (SHPO) indicate that eight smaller-scale Class III surveys have been accomplished in the permit area. Table 3-4 lists all of the Class III surveys conducted. A total of 59 sites have been compiled within the permit area, consisting of 30 historic and 33 prehistoric sites (Table 3-5). Four sites (48CA472, 48CA2702, 48CA2705, and 48CA2706) contain both historic and prehistoric components.

Table 3-4 Cultural Resource Inventories in Rocky Butte Area

Survey	Total Acreage	Acres in Proposed Permit Area	Total Sites		Sites in Proposed Permit Area		Reference
			Historic	Prehistoric	Historic	Prehistoric	
Science Applications	2400	60	2	18	0	3	Southward & Friedman (1981)
Powers Elevation	2300	1450	2	3	1	1	Persinger et al. (1981)
Powers Elevation	4420	4420	9	8	9	8	Floodman & Friedman (1983)
Office of State Archaeologist	9440	548	21	23	3	1	Eckles et al. (1980)
Office of State Archaeologist	0	0	2	0	1	0	Hauff & Eckles (1982)
Larson-Tibesar Associates	1960	560	5	3	1	0	Tibesar et al. (1983)
Mariah Associates	4281	4281	14	20	14	20	Mariah (1991, in prep.)
Powers Elevation	40	40	0	0	0	0	Project #800005
Senco-Pheonix	48	48	0	0	0	0	Project #811321
Metcalf-Zier Arch. Cons.	40	40	0	0	0	0	Project #812098
John Greer	40	40	0	0	0	0	Project #830950
Pronghorn Anthro. Assoc.	10	10	0	0	0	0	Project #840111
Archaeological Energy Cons.	40	23	0	0	0	0	Project #850675
Bureau of Land Management	6	6	1	1	1	0	Project #870561
Frontier Archaeology	10	10	0	0	0	0	Project #880608
TOTAL	25035	11536	56	76	30	33	

Table 3-5 Rocky Butte Archaeological Inventory

Smithsonian No.	Site Type	Site Period	Reference	Eligible	Area
48CA289	Homestead/Ranch	Historic	Eckles et al. (1980) Hauff & Eckles (1982)	No*	Within the mine area
48CA472	Open Camp	Middle & Late Archaic,	Eckles et al. (1980)	Yes**	Within the mine area
	Debris Scatter	Prehistoric/Historic	Hauff & Eckles (1982)	No*	
48CA473	Debris Scatter	Historic	Eckles et al. (1980)	No	Within the mine area
48CA1093	Lithic Scatter	Prehistoric	Southward & Friedman (1981)	No	Railroad corridor
48CA1094	Lithic Scatter	Prehistoric	Southward & Friedman (1981)	No	County road realignment
48CA1278	Lithic Scatter	Prehistoric	Persinger et al. (1981)	No	County road realignment
48CA1279	Lithic Scatter	Prehistoric	Persinger et al. (1981)	No	County road realignment
48CA1281	Homestead	Historic	Persinger et al. (1981) Mariah (1991)	No	Within the mine area
48CA1504	Homestead	Historic	Hauff & Eckles (1982)	No	Outside mine area
48CA1966	Homestead	Historic	Tibesar et al. (1983) Mariah (1991)	No	Outside mine area
48CA1968	Homestead	Historic	Floodman & Friedman (1981)	No	Within the mine area
48CA1969	Homestead	Historic	Floodman & Friedman (1981)	No	Within the mine area
48CA1970	Debris Scatter	Historic	Floodman & Friedman (1981)	No	Within the mine area
48CA1971	Homestead	Historic	Floodman & Friedman (1981)	No	Within the mine area
48CA1972	Homestead	Historic	Floodman & Friedman (1981)	No	Within the mine area
48CA1973	Homestead	Historic	Floodman & Friedman (1981) Tibesar et al. (1983)	No	Within the mine area
48CA1974	Homestead/Ranch	Historic	Floodman & Friedman (1981) Tibesar et al. (1983)	Yes	Within the mine area
48CA1975	Probable Homestead	Historic	Floodman & Friedman (1981) Tibesar et al. (1983)	No	Within the mine area
48CA1976	Ranch	Historic	Floodman & Friedman (1981)	No	Within the mine area
48CA1977	Lithic Scatter	Prehistoric	Floodman & Friedman (1981)	No	Within the mine area
48CA1978	Lithic Scatter	Prehistoric	Floodman & Friedman (1981)	No	Within the mine area
48CA1979	Lithic Scatter	Prehistoric	Floodman & Friedman (1981)	No	Within the mine area

Table 3-5. Rocky Butte Archaeological Inventory (cont.)

Smithsonian No.	Site Type	Site Period	Reference	Eligible	Area
48CA1980	Lithic Scatter	Prehistoric	Floodman & Friedman (1981)	No	Within the mine area
48CA1981	Lithic Scatter	Prehistoric	Floodman & Friedman (1981) Tibesar et al. (1983)	No	Within the mine area
48CA1982	Lithic Scatter	Prehistoric	Floodman & Friedman (1981)	No	Within the mine area
48CA1983	Lithic Scatter	Prehistoric	Floodman & Friedman (1981)	No	Within the mine area
48CA1984	Lithic Scatter	Prehistoric	Floodman & Friedman (1981) Tibesar et al. (1983)	No	Within the mine area
48CA2483	Debris Scatter	Historic	SHPO, Records search (1991)	No	County road realignment
48CA2693	Homestead/Ranch	Historic	Mariah (1991)	Unknown	County road realignment
48CA2694	Road	Historic	Mariah (1991)	Unknown***	Within the mine area
48CA2695	Habitation/ Possible Homestead	Historic	Mariah (1991)	Unknown	Within the mine area
48CA2696	Lithic Scatter	Prehistoric	Mariah (1991)	Unknown	Within the mine area
48CA2697	Lithic Scatter	Prehistoric	Mariah (1991)	Unknown	Within the mine area
48CA2698	Debris Scatter	Historic	Mariah (1991)	Unknown	Within the mine area
48CA2699	Homestead/Ranch	Historic	Mariah (1991)	Unknown	Within the mine area
48CA2700	Agricultural Debris	Historic	Mariah (1991)	Unknown	Within the mine area
48CA2701	Lithic Scatter	Prehistoric	Mariah (1991)	Unknown	Within the mine area
48CA2702	Lithic Scatter/ Debris Scatter	Prehistoric/ Historic	Mariah (1991)	Unknown	Within the mine area
48CA2703	Lithic Scatter	Prehistoric	Mariah (1991)	Unknown	Within the mine area
48CA2704	Lithic Scatter	Prehistoric	Mariah (1991)	Unknown	Within the mine area
48CA2705	Lithic Scatter/ Debris Scatter	Prehistoric/ Historic	Mariah (1991)	Unknown	Outside mine area
48CA2706	Lithic Scatter	Prehistoric	Mariah (1991)	Unknown	Outside mine area
	Habitation/ Possible Homestead	Historic			
48CA2707	Lithic Scatter	Paleoindian	Mariah (1991)	Unknown***	Within the mine area
48CA2708	Open Camp	Possible Paleoindian	Mariah (1991)	Unknown***	Within the mine area
48CA2709	Debris Scatter	Historic	Mariah (1991)	Unknown	County road realignment
48CA2710	Farmstead	Historic/Modern	Mariah (1991)	Unknown	Outside mine area
48CA2711	Lithic Quarry	Prehistoric	Mariah (1991)	Unknown	Outside mine area
48CA2712	Lithic Scatter	Prehistoric	Mariah (1991)	Unknown***	Outside mine area
48CA2713	Lithic Scatter	Prehistoric	Mariah (1991)	Unknown	Outside mine area
48CA2714	Dump	Historic	Mariah (1991)	Unknown	Outside mine area

Table 3-5. Rocky Butte Archaeological Inventory (cont.)

Smithsonian No.	Site Type	Site Period	Reference	Eligible	Area
48CA2715	Habitation/ Possible Homestead	Historic	Mariah (1991)	Unknown	Outside mine area
48CA2716	Lithic Scatter	Prehistoric	Mariah (1991)	Unknown	Outside mine area
48CA2717	Lithic Scatter	Prehistoric	Mariah (1991)	Unknown***	Outside mine area
48CA2718	Secondary Lithic Procurement	Prehistoric	Mariah (1991)	Unknown	Railroad corridor
48CA2719	Open Camp	Prehistoric	Mariah (1991)	Unknown***	Railroad corridor
48CA2720	Lithic Scatter	Prehistoric	Mariah (1991)	Unknown	Railroad corridor
48CA2721	Stockherder Camp	Historic	Mariah (1991)	Unknown	Outside mine area
48CA2722	Lithic Scatter	Prehistoric	Mariah (1991)	Unknown	Outside mine area
48CA2723	Lithic Scatter	Paleoindian	Mariah (1991)	Unknown***	Within the mine area

* Site mitigated through data recovery.
** Site partially mitigated through data recovery.
*** Believed eligible - final determination pending.

The cultural resource base includes diagnostic remains indicating aboriginal occupation of the proposed permit area during the Paleoindian; Middle and Late Plains Archaic; and Late Prehistoric periods. The prehistoric sites consist primarily of lithic scatters with some lithic resource procurement localities and open camps.

More intensive investigations have been carried out only at a few sites in the southwestern portion of the proposed permit area during cultural resource investigations associated with the Caballo Mine (Hauff and Eckles 1982). This work included detailed mapping, surface collections, and analysis at one historic site (48CA289) and both intensive surface documentation and excavations at a multicomponent prehistoric/historic site (48CA472). At the latter site, investigations were very productive, revealing hearths associated with abundant lithic remains and demonstrating occupation during much of the Archaic and Late Prehistoric periods.

The presence of Hell Gap and Agate Basin projectile points at two sites (48CA2707 and 48CA2723) recorded during the 1991 Mariah survey suggest that they and possibly a third adjacent site (48CA2708) with similar lithic characteristics comprise a Paleoindian site complex. This locality warrants further investigation and may contain significant information potential. Subsurface cultural materials recovered during testing at two additional sites (48CA2712 and 48CA2719) also indicate they may be eligible to the National Register of Historic Places (NRHP). One other site (48CA2717) in this inventory is associated with alluvium and indicates additional subsurface investigations are warranted. The rest of the prehistoric sites do not appear eligible, except for 48CA472 mentioned previously.

3.8.2 Historical Resources

Historic land use of the permit area began in Wyoming's Territorial Period (1868-1890) and has continued with increased intensity and variety to the present. Comprehensive historical overviews of the eastern Powder River Basin by Markoff (1981) and Rosenberg (1991) have been prepared in conjunction with cultural resource investigations for recent coal development.

Campbell County was created in 1911, with Gillette as the new county seat. Shortly thereafter, changes in the homesteading laws, state sponsored recruitment efforts, and favorable crop prices combined to draw many potential dryland farmers to the marginal lands of Wyoming. Stock raising, of cattle and sheep, was more successful and expanded following the passage of the Stock Raising

Homestead Act of 1916, which permitted entries of 640 acres.

Homesteading in the region which includes the permit area began during the first decade of the twentieth century. The greatest number of homestead entries were made during a period beginning in the mid-1910s through the early 1920s. Livestock grazing continued as the primary economic land use of the central Campbell County area, although years of drought and the Great Depression of the 1930s caused the abandonment and foreclosure of many homesteads in the Powder River Basin. In many cases, failed ranches were acquired by those that survived.

Commercial coal and oil extractive industries began in Campbell County just before World War I. The Wyodak Coal Mine near Gillette, which began operation in 1923, was the only commercially successful coal mine until the 1970s. During World War II, coal production intensified in Campbell County. Demand for coal fell by the late 1950s, largely due the transition from coal to diesel as railroad fuel. However, by the late 1960s the demand for inexpensive low sulfur coals for power plants increased, spurring the development of many new mines in the Powder River Basin. The Burlington Northern line from Orin Junction to Gillette was constructed in the 1970s to serve these new mines. In the late 1940s many oil leases were taken up in the proposed permit area. The output of these industries fluctuated with supply and demand cycles in the 1960s, 70s, and 80s.

A series of cultural resource inventories identified 30 historic sites within the area (Table 3-5). These sites are all associated with historic Euroamerican settlement, ranching, and agriculture in the permit area. The types of historic sites represented in the area include abandoned and occupied homestead/ranches, camp sites, dumps and debris scatters, and an early road. A total of 17 historic isolated finds have also been recorded within the area.

Three historic sites within the proposed permit area are believed eligible to the NRHP. One of these sites (48CA289) has previously been subjected to data recovery which appears to be adequate for mitigation of any adverse effects. One historic site listed in the SHPO files as eligible (48CA1974) required re-evaluation by Mariah in 1991, resulting in a finding of believed eligibility. One other historic site recorded in the Mariah survey (49CA2694) is also believed eligible. One site (48CA2483) encountered in the file search was unevaluated; historic evaluation conducted by Mariah during the 1991 survey indicated that this site is not believed eligible. None of the other historic sites in the cultural resource inventory is believed eligible.

3.8.3 Paleontological Resources

The proposed permit area contains exposures of the sedimentary Eocene Wasatch and Paleocene Fort Union formations. The Wyodak-Anderson Coal Bed, deposited approximately 55 million years ago in a northwesterly flowing, warm-temperate, intermontane basin fluvial system, occurs in the eastern Powder River Basin, in the Tongue River member of the Fort Union formation. Vertebrate, invertebrate, and paleobotanical fossils are known to occur within both the Wasatch and Fort Union formations over a large area. Vertebrate fossils are considered most important, because of their rarity and scientific value.

A paleontological survey of the proposed permit area in 1991 (Breithaupt, 1991) did not detect the presence of significant vertebrate, invertebrate, or paleobotanical resources within the mine permit area. Fossil plant material consisting of leaf and stem impressions, as well as scraps of petrified wood and small fossilized stumps were found to occur in the permit area. These paleobotanical fossils were determined to be common and of poor preservation quality, and thus unimportant. However, there exists the possibility that buried significant fossil remains, particularly those of vertebrate fauna, exist beneath the visible ground surface.

3.9 Recreation

Sport hunting is the principal recreational land use within the proposed permit area. Hunting for pronghorn antelope, mule deer, and white-tailed deer occurs on and adjacent to the proposed permit area. Mourning dove, sage grouse, waterfowl, and cottontail rabbit are also harvested. Since land ownership within the permit area is predominantly private--except for state school Section 36, T.49N., R.71W.--public access is limited; however, some

landowners permit sportsmen to cross or to hunt on their lands, charging $50-100 trespass fees (WGFD, 1991).

The proposed permit is within pronghorn Hunt Area 24 and within mule deer/white-tail deer Hunt Area 21. Boundaries for both Hunt Areas are the same, encompassing 225,000 acres. Hunter survey data are presented in Table 3-6.

Approximately 60-70 antelope are harvested each year on the Rourke property, and in some years as many as 125-140 are taken. The Greer lease also has a significant antelope harvest. Five mule deer were harvested on the Rourke property in 1991. White-tails are infrequently harvested from the area (personal communication, Chuck Rourke, 1991).

Some non-consumptive use of wildlife (i.e., observation) takes place on the western border of the proposed permit area, both incidentally and through a self-guided "wildlife and natural history loop tour" developed by the WGFD (Campbell County, Wyoming, 1991).

Table 3-6. Hunter Survey for Hunt Areas 21 and 24 (Campbell County, Wyoming): Mule Deer, White-Tailed Deer, and Antelope, 1990.

	Hunt Area[1]	Hunters	Harvest	Hunter Success[2]	Days/ Harvest	Rec Days
MD	21	403	259	64.3	5.4	1402
WT	21	35	11	31.4	8.7	96
ANT	24	881	1119	127.0	2.0	2268

[1] MD - Mule Deer; WT - White-Tailed Deer; ANT - Antelope.
[2] Hunter success is expressed as a percentage. Many antelope hunters in this area harvest more than one antelope which accounts for the high success rate.

Source: McWhirter, Doug. Wildlife Biologist (Bio-Services). 1991. Wyoming Game and Fish Department, Cheyenne.

3.10 Climate and Air Quality

3.10.1 Climate

The Eastern Powder River Basin has a high frequency of clear sky and dry air conditions, receiving approximately 67 percent of the possible sunshine (BLM, 1979) and having 55 to 60 percent average relative humidity. Radiative cooling contributes to large diurnal temperature variations. The average diurnal temperature differences are approximately 34°F in July and 22°F in January. Variations of up to 50°F are not uncommon. January is the coldest month with a mean daily temperature of 20°F. July, the hottest month, has a mean daily temperature of 71°F. Extreme values range from -34°F to 104°F in these same months. The Gillette area has an average frost-free growing season of 129 days. The 150-day average between the last spring and first fall occurrence of 28°F or below is a better indicator of growing season for native plants.

The climate is semi-arid with an average annual precipitation near 15 inches. Monthly precipitation is highest in May and June and lowest in December, January and February. About 40 percent of the annual precipitation falls as snow averaging 63 inches (Martner, 1986). Regional evaporation potential considerably exceeds precipitation.

Average annual wind speed is 12 miles per hour (mph) with winter gusts often reaching 30 mph and sometimes exceeding 40 mph. Regional wind speeds are highest in the winter and spring (BLM, 1979). Generally, the lightest winds occur during the summer months. Regionally, winds are

predominantly westerlies, altered to northwesterlies by major topographic features. Secondary south and southwesterly winds occur in the summer. The absence of high topographic features in the immediate vicinity limits the formation and duration of temperature inversions. There are an average of 15 air-stagnation events annually with an average duration of 2 days (BLM, 1974).

Wind velocity data collected on the nearby Belle Ayr Mine site by Amax Coal Company is representative of conditions at the Rocky Butte Mine site (Figure 3-9). The pattern is one dominated by winds from the northwest, south and southwest.

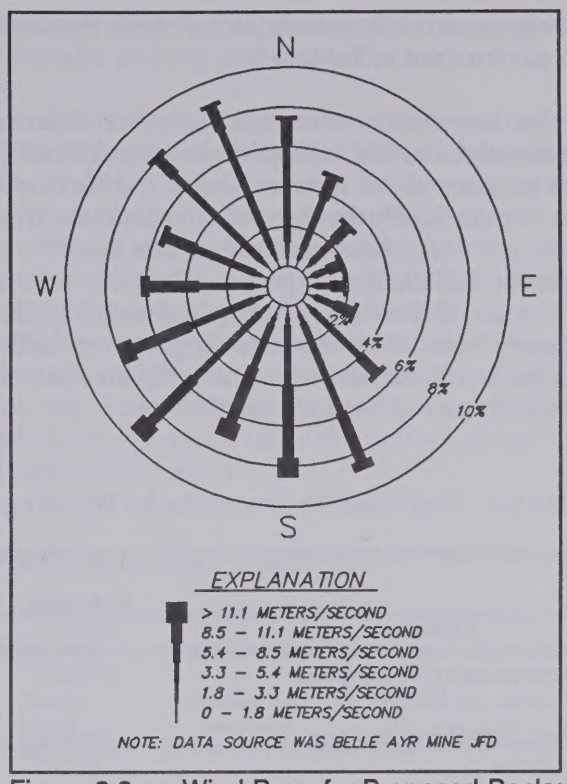


Figure 3-9. Wind Rose for Proposed Rocky Butte Mine Area

3.10.2 Air Quality

The background rural annual geometric mean total suspended particulate (TSP) concentration is about 15 micrograms per cubic meter ($\mu g/m^3$). Regulatory agencies also currently assume that the background concentration of suspended particulates smaller than 10 microns (PM_{10}) is also 15 $\mu g/m^3$. In and near populated areas and active mining operations, particulate levels are significantly higher than background levels (BLM, 1985). Visibility of more than 60 miles is common. Significant reductions in visibility are generally weather-related, although major forest fires to the west and northwest have impaired visibility in the Powder River Basin. A detailed description of the air quality of the area has been produced for the BLM (PEDCO, 1983).

The basic regulatory framework which governs air quality in Wyoming is the Environmental Quality Act, the accompanying Air Quality Rules and Regulations, and the State Implementation Plan (SIP) approved by EPA under the Clean Air Act. This regulatory framework includes state air quality standards, which must be at least as stringent as National Ambient Air Quality Standards (NAAQS), and allowable increments for the prevention of significant deterioration (PSD) of air quality. The air quality standards which apply to coal mining are listed in Table 3-7. The large areas of disturbed land, crushing, loading and hauling of coal, and blasting associated with mining all produce dust which make the particulate standards the most important air quality issue for surface mining.

The current particulate standards in Wyoming are for an annual average of 50 $\mu g/m^3$ and 24-hour average of 150 $\mu g/m^3$ for PM_{10} and a 24-hour average of 150 $\mu g/m^3$ for TSP. The 24-hour standards are not to be exceeded more than once per year. The various motor vehicles used in mining and transport of coal and people also produce carbon monoxide, nitrogen oxides, sulfur dioxide and by secondary processes, ozone, though these are seldom at levels to cause regulatory concerns at Wyoming's surface coal mines.

The PSD program is designed to protect air quality from significant deterioration in areas already meeting state standards. In other words, an increase or increment is allowed above baseline pollution levels so long as the state standard is not exceeded. The size of the increment allowable under PSD depends on the area's designation as a Class I, II, or III area with Class I areas allowed the smallest increment and Class III the largest. The mine area, as is all of Wyoming outside the national parks and wilderness areas, is Class II. Wyoming's PSD

standards, which are identical to federal standards, are summarized in Table 3-8.

In November 1990, the State of Wyoming submitted to the EPA a proposed revision to the SIP. One purpose of the revision was to modify Section 24 of the Air Quality Division (AQD) regulations which deals with PSD. Prior to submission to the EPA, the Wyoming DEQ/AQD held a series of public hearings. During one of the hearings, the Wyoming DEQ/AQD presented testimony documenting that while coal production had increased dramatically, the air quality resource had not been diminished.

A summary of the historical monitoring data for the years 1980 through 1988 is provided as Table 3-9. During this period the number of mines producing coal increased from 10 to 16 while coal production escalated from 58.8 million tons to 139.1 million tons. The number of mines monitoring air quality increased from 12 to 16 (Table 3-9). The number of actual monitoring sites at the mines varied from a low in 1980 of 29 to a high of 46 in 1986. In 1988 there were 45 operating sites. Some of these sites include more than one sampler, so the number of actual high volume air samplers is greater than the number of monitoring sites.

Table 3-7. Regulated Air Emissions for Wyoming

Emissions	Averaging Period	Wyoming Standard ($\mu g/m^3$)	National Standard ($\mu g/m^3$)
Total suspended particulates (TSP)	24-hour[1]	150	---
Particulate matter finer than 10 microns (PM_{10})	24-hour[1]	150	150
	annual[2]	50	50
Nitrogen oxides (NO_x)	annual[2]	100	100
Photochemical oxidants (O_3)	1-hour[1]	160	235
Sulfur dioxide (SO_2)	3-hour[1]	1,300	---
	24-hour[1]	260	365
	annual[2]	60	80
Carbon monoxide (CO)	1-hour[1]	40,000	40,000
	8-hour[1]	10,000	10,000

[1] Standards not to be exceeded more than once per year.
[2] Annual arithmetic mean not to be exceeded

Table 3-8. Maximum Allowable Increases for Prevention of Significant Deterioration of Air Quality in Wyoming

Emission	Averaging Time	Maximum Allowable Concentration Increase (micrograms per cubic meter) Class I	Class II	Class III
Sulfur dioxide	Annual Mean	2	20	40
	24-hour[1]	5	91	182
	3-hour[1]	25	512	700
Total suspended particulates (TSP)	Annual Mean	5	19	37
	24-hour[1]	10	37	75

[1] Not to be exceeded more than once in any 12-month period.

In an effort to summarize the monitoring data in comparative form, averages of the geometric means from all sites were calculated for each calendar year. The averages ranged from a high of 30.8 $\mu g/m^3$ in 1980 to a low of 20.5 $\mu g/m^3$ in 1986. Over 23,000 samples were collected during this period.

Table 3-9 shows that the average of the geometric means went up during 1987 and 1988. It is not clear exactly what caused this increase. Speculation is that it was due to mining activity approaching monitoring sites and to dry conditions due to the regional drought. The third quarter of 1988 may have been impacted by emissions from the forest fires in Yellowstone Park, the Big Horn Mountains and the Rochelle Hills.

Before the TSP annual standard was replaced by the PM_{10} standard, the TSP annual standard was 60 $\mu g/m^3$. As Table 3-9 shows, the annual geometric means measured at all regional mines are well below this former standard. Assuming that PM_{10}, which was not monitored during the years shown in Table 3-9, was about 30 percent of the TSP values, and further assuming that the geometric and arithmetic means are similar, it can be inferred from Table 3-9 that the Powder River Basin mines would have historically been well within the current annual PM_{10} standard of 50 $\mu g/m^3$.

Table 3-9. Summary of Air Quality Monitoring in Wyoming's Powder River Basin, 1980-1988

Year	Number of Mines (Producing/ Monitoring)	Number of Monitoring Sites	Coal (mmt)	Overburden (mmbcy)	TSP Average of All Geometric Means ($\mu g/m^3$)
1980	10/12	29	58.8	93.2	30.8
1981	11/13	34	68.9	108.0	30.4
1982	11/15	43	81.4	120.7	23.1
1983	13/15	41	88.0	157.2	24.3
1984	14/15	44	106.8	166.6	24.3
1985	16/15	45	113.8	196.3	24.3
1986	16/16	46	114.6	169.6	20.5
1987	16/16	45	124.6	180.9	25.6
1988	16/16	45	139.1	209.8	29.3

Note: Mines include Buckskin, Rawhide, Eagle Butte, Fort Union, Clovis Point, Wyodak, Caballo, Belle Ayr, Caballo Rojo, Cordero, Coal Creek, Jacobs Ranch, Black Thunder, North Antelope/Rochelle, Antelope, and North Rochelle.

The conclusion that can be drawn from the information presented by the Wyoming DEQ/AQD is that while coal production increased nearly 2.5 times in the 1980-1989 period, the air quality in the Powder River Basin was not adversely impacted. This is due in part to the conditions attached to air quality permits, which stipulate control measures that must be implemented by the mine operators. These measures can include increased sprinkling, use of chemicals to control dust, limiting the amount of disturbed area, temporary vegetation of disturbed areas, and contemporaneous reclamation.

3.11 Visual Resources

A visual resource evaluation was made for the WRB lease tract and the proposed permit area by Mariah from several observation points along Wyoming Highway 59, the Four Corners Road, and the Fairview Road (Figure 3-10). This evaluation was

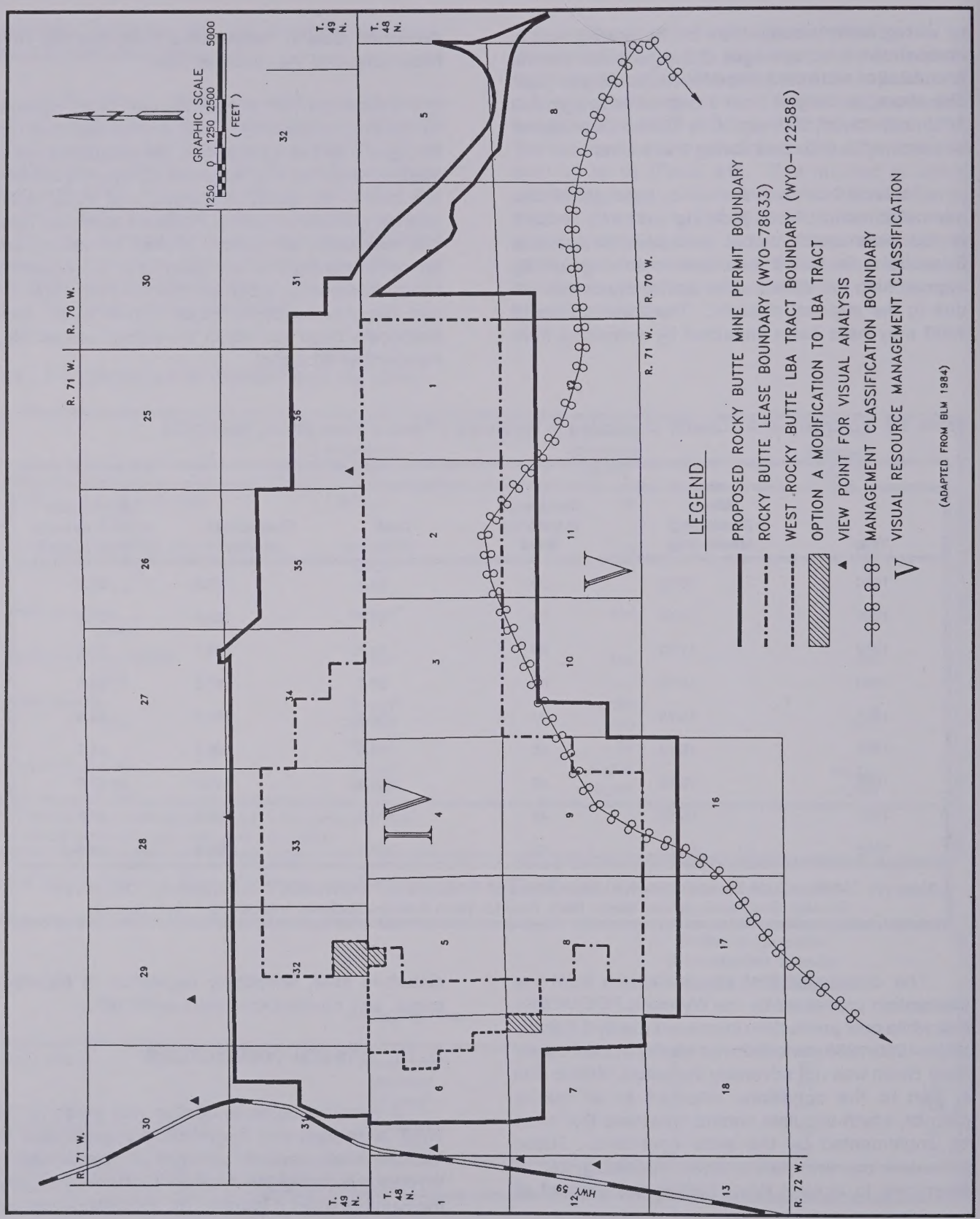


Figure 3-10. Visual Resource Management Classification and Visual Survey Area for Proposed Rocky Butte Mine

made in accordance with the BLM's Visual Resource Management Program (BLM, 1980). The evaluation technique considers scenic quality classes, sensitivity levels, and visual (distance) zones.

Scenic quality classes are defined by a system that rates seven key factors: landform; vegetation; water; color; influence of adjacent scenery; scarcity; and cultural modification. Visual sensitivity levels are determined by people's concern for what they see and the frequency of travel through the area. Visual zones are divided into three categories: foreground/middleground (0 to five miles from a travel route or observation point); background (from five miles to a maximum of 15 miles from an observation point); and seldom seen (along infrequently used roads or beyond 15 miles from an observation point).

In the Rocky Butte evaluation, the scenic quality was determined to be Class C (Appendix C). Class C areas are those that are fairly common to the physiographic region in which they occur. In the case of Rocky Butte, this means a rolling landscape with scattered buttes that lacks variety in land form, color, and contrast, with little variation in vegetation and no unique factors. Major manmade intrusions exist as well, such as subdivisions, ranching, oil and gas development, and electric power transmission lines.

The viewer sensitivity level was estimated to be medium. This level was derived from the assumption that viewer sensitivity is low and traffic volume is high. Viewer sensitivity was assumed to be low because major observation points are along farm to market roads and major commuter routes to and from work areas (often coal mines) rather than along major tourist routes or routes to recreational areas.

When scenic quality class and viewer sensitivity level evaluations are combined with the visual distance zone, which in this case is the foreground/middleground, the visual management class for the Rocky Butte area is class IV (Appendix C).

The visual resource classification of IV for Rocky Butte area is in agreement with the BLM classification for the area south of Gillette that includes this area (BLM, 1984) (Figure 3-10). A portion of the area in the southern portion of the proposed mine permit area is rated as Class V. The class V area in this case includes the existing Caballo, Belle Ayr, Caballo Rojo, and Cordero mines to the south of the proposed permit area.

3.12 Noise

An individual's judgement of the loudness of a noise correlates well with the A-weighted sound level (dBA) system of measurement. The A-weighted sound level, or A-scale, has been used extensively in the U.S. for the measurement of community and transportation noises. Table 3-10 relates A-scale decibel readings to some typical sounds commonly heard in daily life.

The existing noise sources in the proposed lease area are wind, animal life, coal mining activities and limited agricultural activities. Traffic on U.S. Highway 59, which runs along the western side of the proposed Rocky Butte permit area, is an additional source of background noise for portions of the proposed permit area. This highway is the primary route to and from work for the Gillette residents employed at the mines south of Gillette. Traffic on this road is heaviest during daylight hours and at shift changes and includes considerable numbers of large trucks in addition to passenger vehicles. From all these sources, the current noise level in the mine area is probably in the range of 40 to 50 decibels in the eastern part of the mine area and 60 to 70 decibels in the western and southern portions. Background noise levels would depend on time of day and location with respect to the highway and Caballo Mine activities, wind speed, and the presence of insects, birds, and other animals that contribute to background noise.

Figure 3-11 shows the locations of the nearest occupied dwellings to the proposed Rocky Butte Mine. The nearest dwellings to actual mining operations are those located between the proposed permit area and Highway 59. Dwelling no. 1 is more than 2,000 feet from the nearest disturbance, which will consist of the construction of an overburden stockpile during the development of the initial pit. Dwelling no. 2, the closest occupied dwelling to the mine area, will be 500 feet from the nearest disturbance and 125 feet from the permit boundary. Dwelling numbers 3, 4 and 5 are situated 1,250, 2,250 and 3,500 feet, respectively, from the nearest disturbance. Dwelling nos. 7 and 8 and the

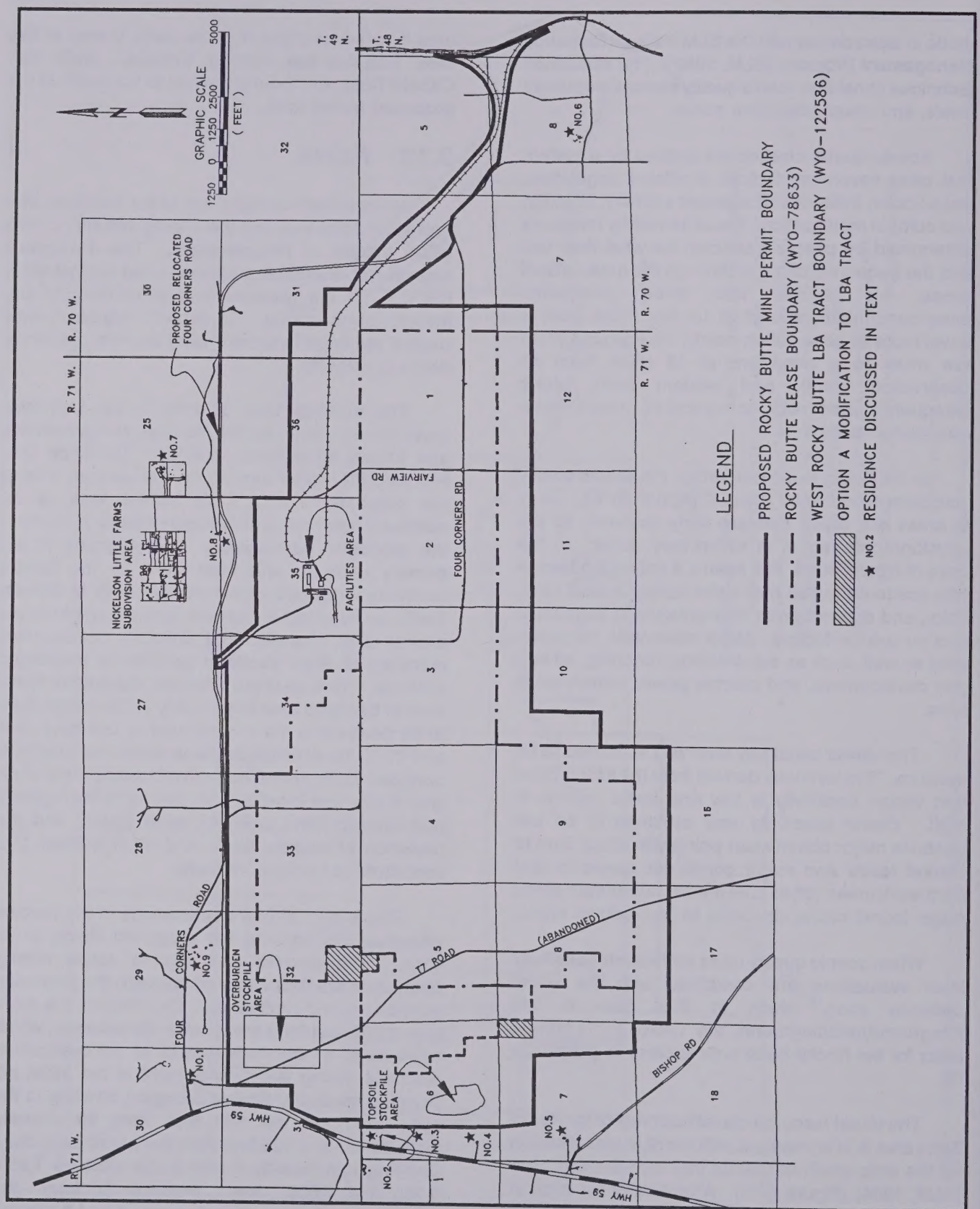


Figure 3-11. Locations of Residences Potentially Subject to Noise Impact and Transportation Facilities in Vicinity of Proposed Rocky Butte Mine

Table 3-10. Typical Noise Levels of Common Occurrence

Noise Perception	Sound	Intensity Level dBA*
Permanent hearing damage	Saturn V moon rocket launch	180
Near permanent hearing damage	Jet aircraft engine (from 75 feet)	130-140
Threshold of pain	Loud rock music	120-130
Uncomfortably loud	Scraper-loader	110
Discomfort threshold	Jet airplane (from 1000 feet)	100
Very loud interferes with conversation	Heavy city traffic	90
Hearing damage threshold for prolonged exposure	Air Compressor (from 20 feet)	85
Nuisance level	Small outboard motor	80
	Vacuum cleaner	70
Quiet	Conversational speech	60
	Window air conditioner	50
	Rustling leaves	20

* dBA = logarithmic measure of noise intensity (based on the A scale).

Sources: Zilly, R.G., ed., Handbook of Environmental Civil Engineering, 1975.
Shortley, G. and Williams, D., Elements of Physics, Vol. II, 3rd Ed., 1964.
Merritt, F.S., ed., Standard Handbook for Civil Engineers, 2nd Ed., 1976.

Nickelson Little Farms subdivision are located over one-half mile from the permit boundary and a mile or more from the nearest disturbance, the facilities area in Section 35.

3.13 Transportation Facilities

The primary transportation systems within Campbell County are a road system and a railroad system. Minor amounts of passengers and freight are carried by two regularly scheduled air lines and private and charter aircraft. The railroad lines, major highways and county roads in the region near the proposed Rocky Butte Mine are shown in Figure 2-2. A more detailed plan of the road and railroad system in and around the proposed Rocky Butte Mine site is shown in Figure 3-11.

3.13.1 Railroads

The main line of the Burlington Northern Railroad (BNR) runs east-west through Gillette. A 127 mile branch line, the Orin-Gillette line, runs south from the Donkey Creek Junction, 5 miles east of Gillette, to Orin Junction near Douglas. This branch serves to transport coal from mines in the central and southern parts of Campbell County to mainlines in Gillette or Douglas. Mines currently served by this line include the Caballo, Belle Ayr, Caballo Rojo, Cordero, Coal Creek, Jacobs Ranch, Black Thunder, North Rochelle, Rochelle, North Antelope and Antelope mines. The Orin-Gillette branch would also serve the proposed Rocky Butte Mine. In 1990 an average of 59.5 unit train round trips per day, including both BNR and Chicago and Northwestern Railroad (CNW) trains, used the Orin-Gillette line. The Gillette main line averaged approximately 32.8 unit train round trips per day. The first three quarters of 1991 saw an average of 61.5 unit train round trips per day on the Orin-Gillette Branch Line (Basford, 1991).

3.13.2 Roads

The road system in Campbell County consists of over 400 miles of paved highway maintained by the State of Wyoming; 1000 miles of roads, 150 miles of that paved, maintained by the Campbell County Road and Bridge Department; and the city streets maintained by the various towns and cities within the county.

The main access to the proposed Rocky Butte Mine is via State Highway 59 and the Four Corners County Road (Figure 3-11). State Highway 59, running south from Gillette to Douglas, is a two lane highway except for the 3 mile section just south of Gillette where it is four-lane. The average 1990 traffic

count on Highway 59 near the Four Corners Road intersection was 4200 vehicles per day (Urich, 1991). Level of Service (LOS) analysis for this area currently shows 645 vehicles per hour, about 36 percent of the capacity of the highway. The corresponding LOS is a low C value (Lane, 1991). The Four Corners Road is an unpaved, two-lane road serving local ranches and oil field sites. It originates at Highway 59, running generally east-southeast in several east and south legs connected by ninety-degree corners until it intersects Fairview Road. It then continues east and then south for approximately another 2.5 miles before ending. It does not link major activity points. No traffic studies have been done on the Four Corners Road.

3.13.3 Airlines

Gillette and Campbell County are served by two regularly scheduled regional carriers, Mesa Airlines operating as United Express and Continental Express. United Express has four arrivals and departures daily with 600 to 650 passengers departing and approximately the same number arriving per month. The load capacity factor for current operations is approximately 50 percent (Kemp and Bell, 1991). Continental Express also has four flights per day with an average of 900 arrivals and 900 departures per month. The load capacity factor for Continental Express is approximately 83 percent (Morgan, 1991). General and military aviation flights account for an average of 60 to 65 arrivals and departures daily with an unknown number of emplanements and deplanements. The present airport use is moderate, but the terminal building and commercial staging areas are congested. A new terminal building is planned with construction tentatively scheduled for sometime within the first half of the decade (Lundell, 1991).

3.14 Land Use and Ownership

3.14.1 Land Ownership

The proposed Rocky Butte permit area contains 9,647 acres of land. The surface area is comprised of 9,167 acres of private ownership and 480 acres of Wyoming State lands. NWR owns approximately 1,664 acres of the surface within the proposed permit boundary. Figure 3-12 shows the surface ownership within the proposed permit area. Private companies and individuals own the remainder of the land, on which NWR holds leases or will obtain them. All of the surface area over the WRB tract is leased by NWR for surface mining purposes.

The mineral ownership within the proposed permit area is very diverse. There are 259 acres of private coal and 8,908 acres of federal coal. The State of Wyoming owns 480 acres of coal within the permit area. Figure 3-13 provides the various types of mineral ownership. This figure reveals the fact that oil and gas ownership interests are considerably more diverse than the coal ownership. The diverse mineral ownership is the result of fee title to the lands being acquired under the earlier homestead acts.

The WRB tract, which consists of about 393 acres, includes about 326 acres of private oil and gas and about 67 acres of federally owned oil and gas.

3.14.2 Land Use

Oil and gas production has occurred within the proposed permit area since the discovery of the Rainbow Ranch oil field in 1960 (Table 3-11). Currently, there are nine producing wells in the four fields in the permit area. Oil production among the fields ranges from 276 to 9,500 barrels per month. Economic production from the Rourke Gap, Butte Creek, and Rainbow Ranch fields is expected to be exhausted prior to 1997. The production life of the WD field is expected to continue until the year 2008. Data for total production from these fields is not currently available.

Public utility powerlines, telephone cables, oil and gas pipelines, roads, and private water lines exist within permitted rights of way (ROWs) in the permit area. Special-use permits have been issued to Mountain States Telephone and Telegraph, Tri-County Electric Association, Belle Fourche Pipeline Company, Panhandle Eastern Pipeline Company, Phillips Petroleum Company, Jesse and Helen Gray, Robbins Valley Estates, and Campbell County for these ROWs.

Grazing land, which is composed of native shrublands and grasslands, occupies 4,375 acres (45 percent) of the permit area. Rangeland productivity ranges from 0.2 to 0.3 animal-unit

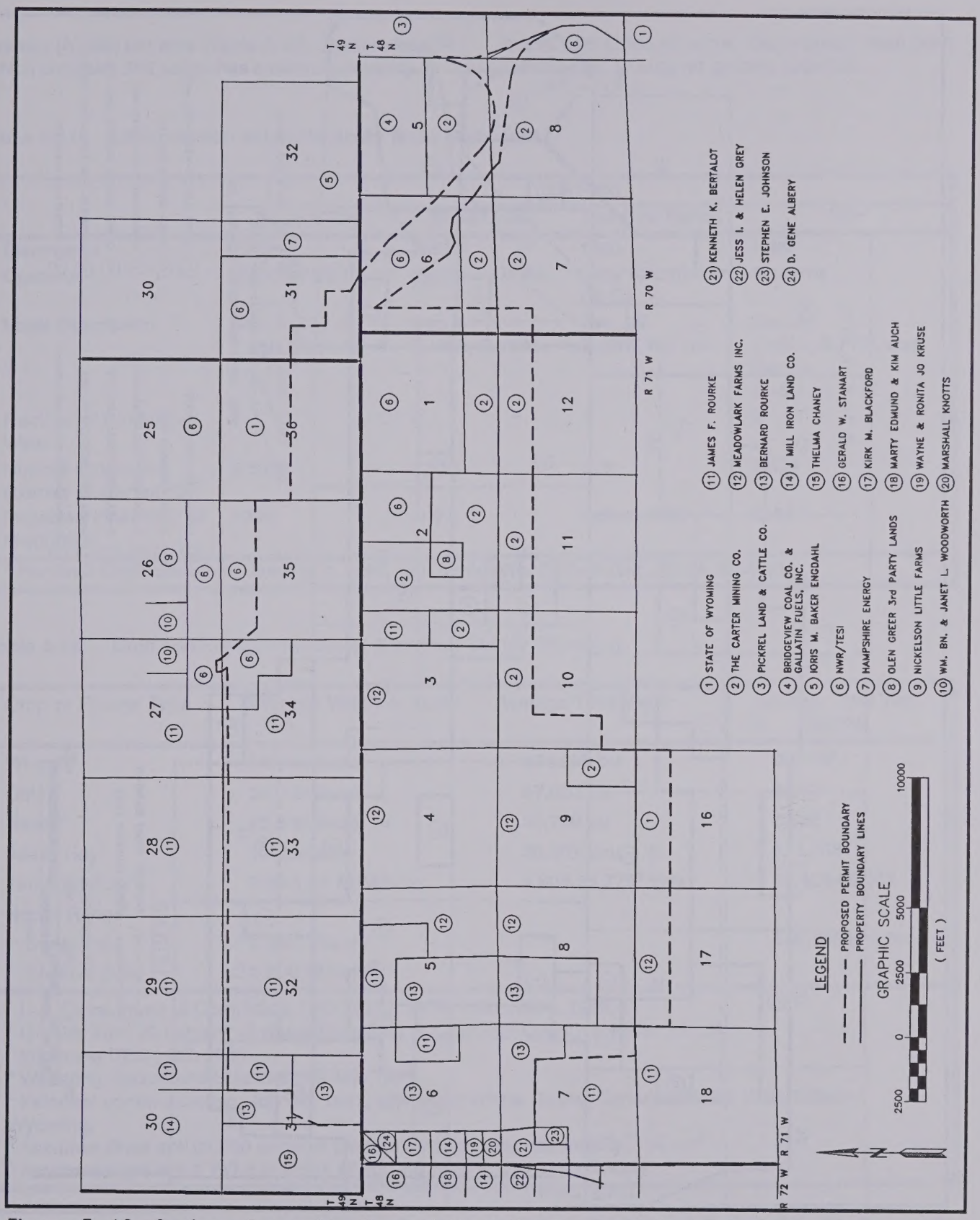

T 49 N
T 48 N
R 71 W
R 70 W
R 72 W
1 STATE OF WYOMING
2 THE CARTER MINING CO.
3 PICKREL LAND & CATTLE CO.
4 BRIDGEVIEW COAL CO. & GALLATIN FUELS, INC.
5 IORIS M. BAKER ENGDAHL
6 NWR/TESI
7 HAMPSHIRE ENERGY
8 OLEN GREER 3rd PARTY LANDS
9 NICKELSON LITTLE FARMS
10 WM. BN. & JANET L. WOODWORTH
11 JAMES F. ROURKE
12 MEADOWLARK FARMS INC.
13 BERNARD ROURKE
14 J MILL IRON LAND CO.
15 THELMA CHANEY
16 GERALD W. STANART
17 KIRK M. BLACKFORD
18 MARTY EDMUND & KIM AUCH
19 WAYNE & RONITA JO KRUSE
20 MARSHALL KNOTTS
21 KENNETH K. BERTALOT
22 JESS I. & HELEN GREY
23 STEPHEN E. JOHNSON
24 D. GENE ALBERY
LEGEND
PROPOSED PERMIT BOUNDARY
PROPERTY BOUNDARY LINES
GRAPHIC SCALE
2500 0 2500 5000 10000
(FEET)
N

Figure 3-12. Surface Ownership On and Near the Proposed Rocky Butte Mine

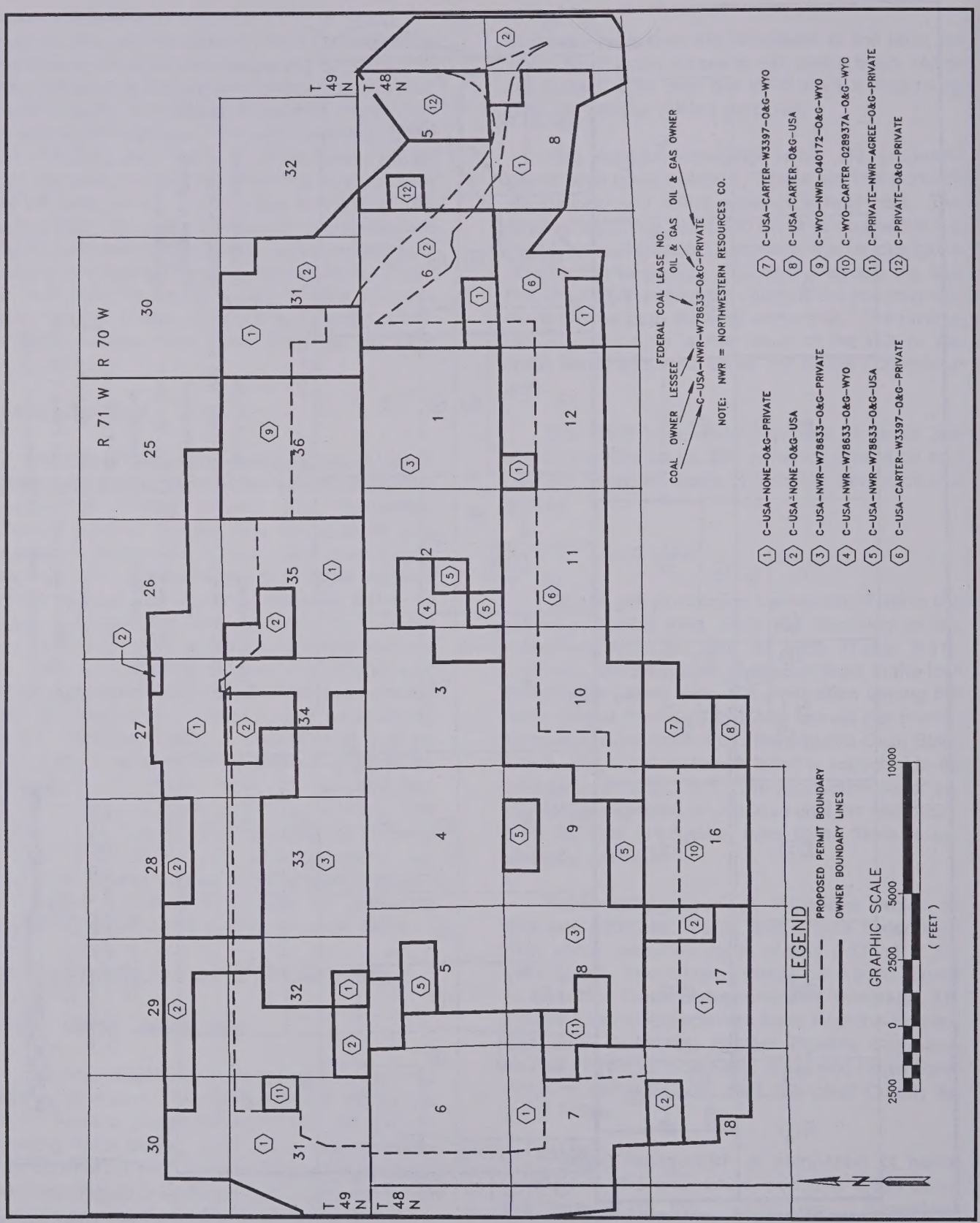


Figure 3-13. Mineral Ownership On and Near the Proposed Rocky Butte Mine

months (AUMs) per acre (Table 3-12). Pasture land, which occupies 569 acres, has a carrying capacity of 0.2 to 1.25 AUMs per acre. Stock ponds have been constructed to support grazing activities.

Table 3-11 Oil Production within the Rocky Butte Study Area.[1]

	Oil Field			
	Rourke Gap	Butte Creek	Rainbow Ranch	WD
Discovered	1973	1985	1960	1989
Operator	Moncrief Oil Co.	Meridian Oil Co.	Jerry Chambers Oil Co.	Ampolex
Legal Description	Sec. 5, 6, 7, 8 T.48N., R.71W.	Sec. 4 T.48N., R.71W.	Sec. 35 T.49N., R.71W.	Sec. 34 T.49N., R.71W. and Sec. 3 T.48N., R.71W.
Number of Producing Wells	3	2	1	3
Current Production (barrels oil per month)	9,500	2,350	276	5,624
Projected Final Year of Production	1995	1997	before 1995	2008

[1] Personal communication, January 2, 1990, with Mark Zora, EnTech, Inc., Butte, Montana.

Table 3-12. Crop and Forage Production, Campbell County, Wyoming.

Crop or Forage Type	Average Yield Per Acre	Average Total Yield	Average Total Yield (AUMs)
Wheat[1,2]	24.6 bu/acre	601,298 bu	90,195[3]
Oats[4]	24.0 bu/acre	87,900 bu	6,153
Barley[4]	25.5 bu/acre	34,750 bu	3,823
Alfalfa Hay[1]	1.0 ton/acre	33,301 tons	111,558
Tame Pasture[5]	0.20-1.25 AUM/acre	4,604-28,775[6] tons	10,405-65,032
Native Range[5]			
Deep Soils	0.3 AUM/acre		549,568-824,352[7]
Shallow Soils	0.2 AUM/acre		

[1] U.S. Department of Commerce 1967, 1972, 1977, 1981, 1984, 1989.
[2] Greater than 90 percent of wheat harvested in Campbell County is winter wheat.
[3] Wyoming DEQ-LQD, 1981.
[4] Wyoming Agricultural Statistics Service, 1991.
[5] Personal communication, July 30, 1991, with Mack White, District Conservationist, SCS, Gillette, Wyoming.
[6] Assumes there are 23,020 acres of pasture land in Campbell County.
[7] Assumes there are 2,747,840 acres of grazing land in Campbell County.

Cropland and grazing land are the principal land use types within the Rocky Butte permit area; however, most land in the permit area supports multiple usage. Agricultural lands, in conjunction with stock ponds, wind breaks, and shelter belts, provide habitat for wildlife.

The proposed Rocky Butte permit area supports an uncharacteristically high percentage of cropland (44 percent); in comparison, Campbell County has only five percent cropland (Table 3-13; personal communication, October 25, 1991, with Tom Jewett, Deputy State Conservationist, SCS, Casper, Wyoming). Hay and winter wheat are the most commonly grown crops. Spring wheat, barley, and oats also may be cultivated. Production within the proposed permit area falls within the range of average production for Campbell County (Table 3-12).

There are three occupied residences and four abandoned homesteads within the permit area. Two major subdivisions, Robbins Valley Estates and Nickelson Little Farms, occur on adjacent lands (within 0.5 mile) to the west and north of the area, respectively. Robbins Valley Estates presently is composed of 11 residences, with eight double-wide trailers and three permanent homes (personal communication, October 29, 1991, with Chuck Rourke, Campbell County, Wyoming). Nickelson Little Farms presently is occupied by more than 110 mobile homes and 10 permanent homes and has potential for future growth (personal communication, August 28, 1991, with Judy Van Damme, Board Member, Nickelson Little Farms).

Table 3-13. Acreage of Land Use Types in Disturbed and Proposed Permit Areas, Rocky Butte Area, Campbell County, Wyoming.

	DISTURBED		PERMIT AREA TOTAL	
Land Use Type	Acres	Percent of Permit	Acres	Percent of Permit
Cropland	3,643	38	4,260	44
Grazing Land	3,020	31	4,375	45
Pasture Land	327	3	569	6
Ponds	52	1	66	1
Residential	12	<1	15	<1
Industrial/Commercial	104	1	137	1
Transportation Systems	130	1	166	2
Disturbed	45	<1	59	1
TOTAL	7,333	75	9,647	100

3.15 Socioeconomics

This section presents historical and current demographic, economic and infrastructure conditions within the area of socioeconomic influence. The emphasis of the discussion is on those communities and political jurisdictions where the majority of mine employees are expected to live, the City of Gillette and Campbell County.

3.15.1. Demographic Characteristics

As Table 3-14 shows, Campbell County experienced a substantial population influx during the period between 1980 and 1985 (Wyoming Department of Administration and Information, Division of Economic Analysis, undated).

With the decline in oil and gas and other mineral activity after 1985, Campbell County population levels declined by more than nine percent. However, a comparison of population changes in Campbell County with those of Wyoming as a whole after 1987 indicates that the County has fared better than other areas of Wyoming in recent years.

The City of Gillette is the largest incorporated community in Campbell County and serves as the primary transportation, trade and service hub for northeastern Wyoming, a five-county area.

Population trends in Gillette have largely mirrored those of Campbell County as a whole (Gillette Department of Community Development, Planning Division, 1990). The population estimates made by the City of Gillette for 1980 and 1990 exceed the final Bureau of the Census estimates by 12 and 9 percent, respectively. It is not known which of the estimates is correct. However, because the analysis in this EIS relies extensively on Bureau of the Census data, the economic and demographic projection are benchmarked to these data.

Table 3-14. Population Change for Campbell County and Wyoming, 1980-1990

Year	Campbell County Population	Percent Change, Campbell County	Percent Change, Wyoming
1980	24,367	NA	NA
1981	30,893	26.8	4.4
1982	31,875	3.2	1.5
1983	31,509	(1.1)	0.2
1984	32,116	1.9	0.6
1985	34,195	6.5	0.8
1986	30,983	(9.4)	(2.5)
1987	28,979	(6.5)	(3.4)
1988	29,057	0.3	(2.4)
1989	29,150	0.3	(1.7)
1990	29,370	0.7	(0.7)

As depicted in Table 3-15, average household size in the City of Gillette and Campbell County declined between 1980 and 1990 (U.S. Department of Commerce, Bureau of the Census, 1983 and Wyoming Department of Administration and Information, Division of Economic Analysis, 1991a). Households in portions of the county outside of Gillette are substantially larger than those in the city and currently average more than 3.1 persons per household.

The age distribution of a population is important in determining labor force availability. According to the 1990 Census, the median age of the population in Campbell County and Gillette is 29.2 years of age (Wyoming Department of Administration and Information, Division of Economic Analysis, 1991a). This compares with a median age of 32 years for the state as a whole. The prime working years are between 18 and 64 years of age.

Table 3-16 indicates that about 61 percent of the population in both Campbell County and Gillette is between 18 and 64 years of age (Wyoming Department of Administration and Information, Division of Economic Analysis, 1991a).

Educational attainment levels can be a measure of the employability of a population and may indicate the type of work for which the labor force is suited.

Table 3-15. Households and Household Size, City of Gillette and Campbell County, 1980 and 1990

	1980		1990	
	City of Gillette	Campbell County	City of Gillette	Campbell County
Population	12,134	24,367	17,635	29,370
Households	4,259	8,085	6,241	9,968
Household size	2.85	3.02	2.78	2.95

Table 3-16. Age Distribution, 1990

Age Group	Gillette	Campbell County	Wyoming
17 years and under	34.4%	35.7%	29.9%
18 to 24 years	8.1%	7.4%	9.1%
25 to 54 years	47.9%	48.1%	42.8%
55 to 64 years	5.1%	5.1%	7.8%
65 years and over	4.5%	3.7%	10.4%
Total	100.0%	100.0%	100.0%

As Table 3-17 shows, educational attainment levels in Gillette and Campbell County compare favorably with Wyoming as a whole (U.S. Department of Commerce, Bureau of the Census, 1983).

The ratio of total employment to the total number of households is useful in developing projections of the number of households. During the period between 1980 and 1990, workers per household decreased by more than eight percent (U.S. Department of Commerce, Bureau of the Census, 1983, Wyoming Department of Administration and Information, Division of Economic Analysis, 1991 and Wyoming Department of Administration and Information, Division of Economic Analysis, 1991b). This decline is likely the result of a smaller labor force and reduced relative economic activity (Table 3-18).

Table 3-17. Educational Attainment Levels: Percent of Population 25 Years Old and Over

	Gillette	Campbell County	Wyoming
High school graduates	81.2%	80.1%	77.9%
College			
1 to 3 years	21.3%	21.9%	20.8%
4 or more years	16.9%	13.4%	17.2%
Median years of school	12.7	12.7	12.7

Table 3-18. Workers Per Household, Campbell County

Year	Employment[1]	Households	Workers Per Household
1980	15,535	8,085	1.92
1990	17,595	9,968	1.76

[1] Includes full and part-time workers.

According to a citizen survey conducted annually by the City of Gillette, workers per household have generally declined since 1985 and averaged about 1.6 workers per household during the past eight years (Gillette Department of Community Development, Planning Division, 1991), slightly less than for the entire county (Table 3-18).

3.15.2. Economic Characteristics

Campbell County economic characteristics are described in this section. Topics include employment and unemployment, personal income, the cost of living, housing availability, retail trade and assessed valuation.

The Campbell County labor force and employment have declined between 1985 and 1990, but an improvement was evident between 1989 and 1990 (Table 3-19) (Wyoming Department of Employment, Division of Research and Planning, 1990 and 1991a). The number of unemployed persons and the unemployment rate were lower in 1990 than any year since the early 1980's. Since 1985, the unemployment rate in the county has exceeded the rate for the state as a whole.

Table 3-19. Employment Summary, Campbell County, 1985-1990, Annual Average

	Year					
	1985	1986	1987	1988	1989	1990
Labor force	18,592	17,377	16,061	15,585	15,788	16,504
Employment	17,280	15,610	14,549	14,503	14,577	15,446
Unemployment	1,312	1,767	1,512	1,082	1,211	1,058
Unemployment Rate	7.1%	10.2%	9.4%	6.9%	7.7%	6.4%

Between 1985 and 1989, all economic sectors demonstrated declines in employment levels with the exception of public administration (see Table 3-20). Construction employment has dropped sharply. However, mining, trade and services continue to be the major Campbell County employment sectors (Employment Security Commission of Wyoming, Research & Analysis Section, undated and Wyoming Department of Employment, Division of Research and Planning, 1991b).

The decline in construction employment is partially indicative of the residential and commercial overbuilding that occurred during the early 1980's.

Table 3-20. Campbell County Employment by Industry, 1985 and 1989

Industry	1985 Number of Persons	1985 Percent[1]	1989 Number of Persons	1989 Percent[1]
Agriculture	NA[2]	NA	43	0.3%
Mining	5,878	34.8	4,405	32.3
Construction	1,928	11.4	802	5.9
Manufacturing	188	0.1	128	0.9
TCU[3]	921	5.4	701	5.1
Wholesale Trade	837	4.9	659	4.8
Retail Trade	2,489	14.7	2,282	16.7
FIRE[4]	442	2.6	350	2.6
Services	3,593	21.2	1,623	11.9
Public Administration	634	3.7	2,652	19.4
Total	16,910	99.8%	13,644	99.9%

[1] Does not sum to 100 percent due to rounding.
[2] Agriculture, forestry and fisheries employment is included in the services sector.
[3] Transportation, Communication and Utilities.
[4] Finance, Insurance and Real Estate.

As shown in Table 3-21, the fourteen largest employers in Campbell County account for more than 5,000 jobs, or about one-third of total employment, in the county (Campbell County Economic Development Corporation, 1991).

Table 3-21. Major Employers in Campbell County, 1991

Employer	Number of Employees
Campbell County School District	1,084
Campbell County Memorial Hospital	500
Thunder Basin Coal Company	488
The Carter Mining Company	475
AMAX Coal Company	469
Kerr-McGee Coal Corporation	378
Burlington Northern Railroad	324
Campbell County Government	295
Powder River Coal Company	287
Cordero Mining Company	225
Pioneer Manor Nursing Home	204
Gillette City Government	155
Mobil Coal Producing	153
Pacific Power & Light	134

Campbell County personal income by industry, as measured by the U.S. Bureau of Economic Analysis, is presented in Table 3-22 (Wyoming Department of Administration and Information, Division of Economic Analysis, 1991b). These data demonstrate the importance of mining in the Campbell County economy; it accounts for more than 46 percent of labor and proprietors' income. The data further illustrate the impact of the decline in construction on personal income in the county.

As Table 3-23 shows, the City of Gillette is a relatively costly place to live when compared to fifteen other Wyoming communities (Wyoming Department of Administration and Information, Division of Economic Analysis, 1988, 1989, 1990, 1991c).

Table 3-22. Personal Income by Industry, Campbell County, 1981, 1985 and 1989

	Thousands		
Industry	1981	1985	1989
Agriculture	$4,389	$1,413	$4,352
Mining	$175,275	$243,547	$204,619
Construction	$132,249	$55,637	$26,319
Manufacturing	$3,497	$3,504	$2,612
TCU[1]	$33,113	$34,072	$30,158
Wholesale Trade	16,464	$23,627	$19,203
Retail Trade	$30,875	$34,114	$29,138
FIRE[2]	$9,055	$10,233	$8,303
Services	$36,695	$47,983	$55,129
Public Administration	$30,182	$55,834	$58,993
Total labor and proprietor's income by place of work	$471,794	$509,964	$439,006
Other Income[3]	$57,199	$78,748	$98,701
Residence Adjustment	($20,107)	($14,365)	($9,117)
Total income by place of residence	$508,886	$574,347	$528,590

[1] Transportation, Communication and Utilities
[2] Finance, Insurance and Real Estate
[3] Includes dividends, interest, rent and net transfer payments

Table 3-23. Cost of Living, City of Gillette, 1989-1991

	1989		1990		1991	
	January	July	January	July	January	July
Cost of living index	103.3	105.6	104.4	103.8	101.0	101.2
Rank (of 15 communities)	3	2	2	3	4	5

A historical overview of the housing stock in the City of Gillette is provided in Table 3-24 (Gillette Department of Community Development, Planning Division, 1990). The housing stock in Gillette has remained quite stable since 1987 with most activity appearing as gains and losses in mobile homes (Table 3-24) (Gillette Department of Community Development, Planning Division, 1991).

The overall vacancy rate in Gillette was about eight percent in 1990, a decline of two percentage points from the previous year. Single family vacancy rates have held steady at about six percent, while multi-family vacancy rates declined from 24 percent in 1989 to 12 percent in 1990. Vacancy rates for mobile homes have remained stable at about eight percent.

Vacancy rates have declined considerably in 1991. The rental market is tight with vacancy rates at approximately two percent, and vacancy rates in the owner-occupied market are slightly higher (Sherry Okray and David Spencer, 1991). Substantial mobile home space, however, is currently available.

There are five financial institutions in Gillette which provide the bulk of financing for home construction and purchasing in the Gillette area. Financing is readily available to credit-worthy developers and home buyers. Mobile home financing is difficult without the purchase of a lot.

As shown in Table 3-25, retail activity in Campbell County is beginning to show signs of recovery (Wyoming Department of Administration and Information, Division of Economic Analysis, 1991d). Several economic sectors, including wholesale trade and finance, insurance and real estate, have yet to regain their levels achieved in the early and mid-1980s. Certain other sectors, such as mining, construction and manufacturing appear to have made substantial gains, even exceeding levels evident in the mid-1980s.

Table 3-24. City of Gillette Housing Stock, 1987-1990

Type of Unit	1987	1988	1989	1990
Single family	4,446	4,443	4,443	4,452
Percent	59.2	60.3	60.1	60.6
Multi-family	1,683	1,684	1,688	1,688
Percent	22.4	22.9	22.8	22.9
Mobile homes	1,107	996	1,023	964
Percent	14.7	13.5	13.8	13.1
Other[1]	271	243	243	243
Percent	3.6	3.3	3.3	3.3
Total	7,507	7,366	7,397	7,347
Percent	99.9*	100.0	100.0	99.9*

[1] Includes transient quarters and occupied recreational vehicles.
* Does not sum to 100.0 percent due to rounding.

Table 3-25. Retail Activity, Campbell County, 1985-1990

Industrial Sector	Millions of Dollars*						
	1985	1986	1987	1988	1989	1990	1991
Agriculture	$0.7	$0.9	$0.6	$0.7	$0.8	$0.8	$0.7
Mining	81.9	79.9	48.9	69.8	71.2	71.6	102.5
Construction	12.9	8.9	7.7	10.1	10.9	10.0	18.5
Manufacturing	16.7	15.2	11.2	21.7	18.2	20.0	21.6
TCU[1]	36.3	36.1	28.4	39.0	36.9	37.5	34.3
Wholesale trade	70.7	57.4	31.7	32.7	33.2	35.6	34.0
Retail trade	178.6	167.9	138.1	139.9	135.9	141.4	143.5
FIRE[2]	0.9	0.6	0.5	0.2	0.1	0.1	0.1
Services	48.0	49.3	31.8	39.4	37.2	39.4	54.6
Public Admin.	36.2	37.1	26.9	21.3	22.9	32.3	31.1
Total	$482.9	$453.3	$298.9	$353.5	$367.3	$388.7	$440.9
Percent change from previous year	NA	(6.1)%	(34.1)%	18.3%	3.9%	5.8%	13.4%

[1] Transportation, Communication and Utilities.
[2] Finance, Insurance and Real Estate.
* These figures are not adjusted for inflation.

3.15.3. Overview of Infrastructure and Public Sector Fiscal Conditions

Public facilities and services within the area of socioeconomic influence are situated mostly in the City of Gillette. This section describes the present condition of water and sewerage systems, public safety, health service delivery, welfare and other social services, and educational facilities. In addition, the current fiscal condition of the Gillette and Campbell County governments is described.

Water service in the City of Gillette is provided principally by the Gillette Department of Public Works. Water is provided outside the city limits to areas which are anticipated to be annexed to the city. All water use in Gillette is metered, and domestic irrigation water can be separately metered at the request of the user. A limited number of households in Gillette are served by domestic water associations.

The source of water for the Gillette system is comprised of ground water from the Fort Union, Fox Hills and Madison formations. Eight wells in Gillette access the Fort Union and Fox Hills formations. Madison ground water is accessed through eight wells and piped 43 miles to the city. Gillette is obligated to deliver 6,000 gpm, 1,000 gpm and 150 gpm, respectively, to the towns of Moorcroft and Rozet and the Wyodak plant. Currently, these obligations are only partially exercised.

The current storage capacity of the Gillette system is 16 million gallons. According to the Public Works Department, an additional five to seven million gallons of storage are necessary. The design peak of the system is 11 million gallons per day (mgd). However, the actual peak is approximately 11.6 mgd. In order to attenuate peak period water use, the department curtails water use on city and county parks and at the CAM-plex. Notwithstanding, the Gillette water system has an Insurance Service Organization (ISO) rating of 1, considered quite good.

Water use in Gillette is fairly high. On a per capita daily basis, water use averages 300 to 350

gallons. High water use is due in part to the low water rates charged by the department. These rates were adopted more to encourage the "greening" of Gillette than to cover the costs of operating the system (Gillette Department of Public Works, 1991).

Utility Department staff believe the current system can adequately serve an additional 10,000 to 15,000 residents assuming peak period water use can be effectively attenuated. This, however, would require a significant revision in the city's policies.

The current sewerage system is the culmination of a four-phase system update completed approximately one year ago. A substantial amount of federal monies was available to upgrade the system which currently meets its NPDES permit requirements (Gillette Department of Public Works, 1991).

The current system consists of collection lines and a treatment plant which is rated at approximately 4.0 mgd. Sewage treatment currently ranges from 2.2 to 2.5 mgd. The system was designed to serve 40,000 people through the addition of small scale, low cost treatment units, or "package plants", at specific locations in the system.

The city-owned and operated electrical system has provided electricity to Gillette residents since 1915. In 1990, the city served 6,538 residential accounts, 1,077 small commercial accounts and 211 large power accounts. Total energy sales in 1990 were roughly 160,000 megawatt hours. The anticipated 1991-1992 winter peak is 40 megawatts. According to the city's Electrical Engineering Division, wholesale power contracts are adequate (Gillette Department of Utilities, 1991).

The Gillette Police Department provides law enforcement services in the City of Gillette, while the Campbell County Sheriff's Department serves the unincorporated portions of the county. Fire protection services are provided by the joint city/county fire department.

The Gillette Police Department staff currently consists of 53 persons including uniformed and non-uniformed, communication, animal control and support personnel. The police department is currently understaffed by five uniformed officers. A number of supervisory personnel, such as the sergeant, spend an inordinate amount of time responding to calls. The incidence of certain violent crimes is higher than what would be expected for a community like Gillette. According to the department, the level of service provided to Gillette residents will decline if calls rise appreciably without additional personnel (Gillette Police Department, 1991).

The Campbell County Sheriff's Department, which currently employs 106 persons, is responsible for operating the county jail and law enforcement in the unincorporated portions of the county. About 18 percent of the staff is support personnel. The sheriff's department also has concurrent jurisdiction with the City of Gillette. The department is currently understaffed by four uniformed patrol officers. Many of the department's calls are in response to minor theft and domestic violence (Campbell County Sheriff's Department, 1991).

The fire department has one fire chief, 10 full-time firemen and 160 volunteers. There are three substations and a training center located in Gillette. Rural portions of the county are served by substations located in Wright, Recluse, Reno Junction, Rawhide and Eston.

In Campbell County, short term medical care is provided by Campbell County Memorial Hospital. The 104-bed facility is currently at 47 percent occupancy.

Pioneer Manor Nursing Home is the only extended care medical facility in Campbell County. The 148-bed facility is currently near capacity.

The Northern Wyoming Regional Counseling Center is the focal point for mental health services in Campbell County. The staff of seven professionals is adequate given current caseload demand (Northern Wyoming Regional Counseling Center, 1991).

The Gillette office of the Wyoming Department of Family Services, Division of Public Assistance and Social Services (DPASS) provides welfare services in Campbell County. DPASS consists of two components. Family Services provides financial assistance to indigent persons, and Social Services assists children, disadvantaged adults and the elderly. Funding for DPASS is obtained from the

state and federal governments. Current staffing is adequate given current caseload demands (Wyoming Department of Family Services, 1991).

The Campbell County School District serves all of Campbell County. The district consists of 22 schools. Of the 15 elementary schools, ten are in Gillette.

School enrollment has fluctuated in a narrow range on an annual basis recently (Table 3-26) (Wyoming Department of Education, selected years). Compared to the state as a whole, the student/teacher ratio in the Campbell County School District is high at 18:1. In addition, schools in the district tend to be more populated than elsewhere in the state (Wyoming Department of Education, 1990b).

Table 3-26. Campbell County School District Enrollment

Academic Year	Fall Enrollment
1986-1987	7,750
1987-1988	7,692
1988-1989	7,760
1989-1990	7,682
1990-1991	7,759

The school district is in adequate financial condition. Assessed valuation per student, nearly $175,000, exceeds the state average of roughly $60,000. The school district currently has zero percent of its bonding capacity obligated (Wyoming Department of Education, 1990b).

Campbell County is in sound fiscal condition due principally to its extraordinarily high tax base. For instance, the county accounted for nearly one-quarter of state-wide assessed valuation in 1989 (Campbell County, budgetary data, 1991).

In Campbell County, revenues are collected to fund general county operations as well as the county health department and seven boards which oversee the county airport, fair, library, museum, parks and recreation operations, weed and pest control and joint city/county fire department. However, the county does not budget revenues. Instead, the county budgets expenditures and estimates the amount of gross revenues available primarily from cash reserves and property and sales taxes.

Table 3-27 illustrates the budgeted appropriations and projected tax revenue requirement for the 1991-92 fiscal year. The county anticipates a county mill levy of 11.265 mills to generate the necessary revenues. This is below the county fund 12.000 mill limit.

The fiscal position of the City of Gillette is quite sound. The city has an aggressive debt restructuring program in order to retire all city debt by the end of the 1995 fiscal year (City of Gillette, Financial Management Program, 1991).

The city budget consists of 12 funds including the general fund. Total budgeted revenues for the 1992 fiscal year are $38.3 million. Budgeted expenditures are $33.0 million, yielding a surplus of roughly $5.3 million.

The majority of general fund revenues in fiscal 1990 were derived from taxes and mineral royalties (Table 3-28).

In seven of the past nine fiscal years, the water enterprise fund has required a subsidy in order to make up cash shortfalls. The power fund will require a subsidy for the first time in fiscal year 1992. According to city staff, revenue shortfalls in these two

funds are principally due to low water and power rates charged to city customers and high operating costs. These subsidies are typically obtained from the severance tax fund.

Table 3-27. Campbell County Budget Summary, 1991-92 Fiscal Year

Fund	Estimated Revenues	Estimated Appropriation	Estimated Tax Requirement	Mill Levy
		Thousands		
General Fund	$32,314	$44,765	$12,451	8.139
Health Department	185	619	434	0.284
Airport Board	54	409	355	0.232
Fair Board	33	216	183	0.119
Library Board	58	1,350	1,292	0.845
Museum Board	4	45	40	0.026
Parks and Recreation Board	562	1,841	1,279	0.836
Weed and Pest Control Board	90	509	419	0.274
Joint Powers Fire Board	290	1,489	1,199	0.783

Table 3-28. City of Gillette, General Fund, 1990

Source	Amount (thousands)	Percent of Total
Taxes	$4,353	66.0%
Mineral Royalties	1,061	16.1
Licenses and permits	250	3.8
Charges for services	505	7.7
Miscellaneous	422	6.4
Total	$6,591	100.0%

A three percent state sales tax is levied in all Wyoming counties. The state sales tax is shared between the state and county-of-origin governments at rates of 63.33 percent and 36.67 percent, respectively. The current allocation rates are set to expire on June 30, 1992. Counties were granted the option in 1973 to impose an additional one percent sales tax through public vote. This tax revenue, less state administration costs, is returned to the county-of-origin to be used for general fund purposes. The state also imposes a three percent use tax to prevent sales tax avoidance. This tax revenue is shared with counties-of-origin on the same basis as the sales tax. In addition, the optional county sales tax is coupled with a one percent use tax for use in the county's general fund. Sales and use tax revenues are shared between counties and municipalities on the basis of population.

As Table 3-29 shows, sales and use tax revenues for Campbell County as a whole increased by more than 14 percent between 1989 and 1990 (Wyoming Department of Revenue and Taxation, selected years). For the period between 1987 and 1990, tax revenues increased by more than 35 percent, or 10.7 percent annually.

Table 3-29. Distribution of Sales and Use Tax within Campbell County, 1987-1990

Jurisdiction	Thousands of Dollars*			
	1987	1988	1989	1990
Campbell County	$2,897	$3,397	$3,409	$3,897
Gillette	4,486	5,764	5,785	6,612
Wright	372	440	441	504
Total	$8,115	$9,601	$9,635	$11,013

* These figures are not adjusted for inflation.

In 1990, assessed value in Campbell County was more than $1.45 billion. County mineral properties account for more than 80 percent of the total assessed valuation as shown in Table 3-30 (Wyoming Department of Revenue and Taxation, selected years).

In 1990, nearly $86.7 million in tax revenues were collected in Campbell County, the majority of which are levied for the school district (Wyoming Department of Revenue and Taxation, selected years) (see Table 3-31).

Table 3-30. Campbell County Assessed Value, 1988-1990

Assessment Class	Millions of Dollars		
	1988	1989	1990
Land	$6.38	$6.24	$4.41
Other Personal Property	92.43	102.85	115.60
Real Property	74.77	72.88	65.41
Utilities	30.97	31.47	33.10
Minerals	1,121.13	1,118.11	1,231.80
Total Assessed Value	$1,325.68	$1,331.55	$1,450.32

Table 3-31. Taxes Levied, Campbell County, 1988-1990

	Thousands of Dollars		
	1988	1989	1990
School Foundation Program	$15,908	$15,979	$17,404
County taxes	14,767	14,871	16,157
District taxes	5,207	4,948	4,891
School taxes	41,096	41,944	47,860
Special municipal taxes	426	411	381
Total taxes	$77,404	$78,153	$86,693

For all Wyoming counties, the Foundation Program mill levy is 12.000 mills. The Campbell County School District mill levy is 32.500 mills. The mill limit on county taxes is 12.000 mills.

The total mill levy in Gillette for the year 1990 was 66.583 mills, yielding tax collections amounting to nearly $3.1 million (Wyoming Department of Revenue and Taxation, selected years). The majority of property taxes collected in the city went to the Campbell County School District (see Table 3-32).

Because of the cyclical nature of the mineral and oil industries, Gillette has been perceived as a "boom town". During periods of prosperity, the area experienced large population influxes as people in-migrated to take advantage of considerable employment opportunities. However, the decline in local economic activity in the mid-1980s led to considerable unemployment in the area and a substantial out-migration of residents.

A recent survey conducted by the Gillette Department of Community Development demonstrates that quality of life available to residents of Gillette has improved since the mid-1980's. In 1991, more than 93 percent of those surveyed would recommend Gillette as a place to live. This compares with 77.6 percent in 1986. On a scale of one to ten, where ten is high, Gillette received a rating of about 7.5 as a place to live. Gillette residents have more longevity in the area. In 1991, about 15 percent of the survey respondents indicated that they had resided in Campbell County for fewer than five years. This compares with more than 37 percent in 1986.

Residents are less concerned about the economy now than in 1987 when more than two-thirds of the survey respondents believed that economic development was the most important issue facing the area. Other considerations such as the environment and growth management have received higher emphasis.

Table 3-32. Assessed Valuation and Taxes Levied, Gillette, 1988-1990

	Thousands of Dollars				
Year	Municipal Valuation	County Tax Levy	School Tax Levy*	Municipal Tax Levy	Total Tax
1988	$53,134	$788	$2,285	$395	$3,468
1989	51,071	749	2,222	383	3,354
1990	46,504	666	2,069	361	3,096

* Includes Foundation Program.

4.0 ANALYSIS OF PROPOSED ACTION AND ALTERNATIVES

The first subsection of this chapter describes the environmental effects of the Proposed Action, mining of the West Rocky Butte LBA tract and the Rocky Butte lease tract as an LMU. Effects are described for each of the environmental and socioeconomic disciplines described in the preceding chapter. The second subsection of this chapter describes the environmental effects of the No Action Alternative. Cumulative effects of the Proposed Action are described in Chapter 6.

Some of the effects are discussed in the context of their duration. Short-term impacts are those that occur during the 52-year period from premining development through the end of mine life, assuming a 10-year period for reclamation evaluation and bond release after reclamation activities are completed. Long-term impacts of the project are those that persist beyond the end of mine life.

The geographical limits for the analysis of impacts in this EIS are dependent upon the type of impact being analyzed. For some resources the impact analysis is confined to the permit area. Geographical limits for detailed analysis for resources where the analysis extends beyond the permit area are as follows:

- Air Quality - Impacts are analyzed for the six-mine cluster extending from Rocky Butte on the north to Coal Creek on the south.

- Water Resources - Impacts are analyzed for a region that encompasses the entire area within which the Wyodak-Anderson coal aquifer is subject to 5 feet or more of drawdown resulting from mining at the same six mines included in the air quality analysis plus the Wyodak Mine to the north.

- Wildlife - Impacts are analyzed generally within a locality consisting of a 2-mile wide buffer zone around the Rocky Butte life-of-mine area. Buffer zones for specific features of interest can extend beyond this limit.

- Socioeconomics - Impacts are analyzed for the Rocky Butte Mine and for a region encompassing Campbell County and the city of Gillette where most of the employment impacts will occur.

- Transportation - Impacts are analyzed for the local infrastructure which serves the Rocky Butte Mine and the region encompassing the Campbell County mines in general, with particular emphasis on Highway 59, the BN and CNW railroads, and county roads on and near the life-of-mine area.

- Visual Resources - Impacts are analyzed for the life-of-mine area and for a region encompassing the six-mine cluster included in the air quality impact assessment.

- Noise - Impacts are analyzed for the area where noise from the mine would exceed ambient levels.

Impacts are also discussed in terms of their significance. The basis for conclusions regarding significance are the criteria set forth by the Council on Environmental Quality (CEQ) (40 CFR 1508.27) and professional judgement of the specialists performing the analyses. Significance of various impacts may range from insignificant to severe, and impacts can be significant during mining and reduce to insignificant following completion of reclamation.

Finally, some impacts are discussed in terms of their magnitude. The magnitude of an impact can range from negligible, such as effects on noise levels in the region, to major, such as effects on vegetation within the disturbed area during the mine life.

Table 4-1 summarizes the impact analysis and compares impacts for the two primary alternatives. Certain cumulative impacts are included in Table 4-1, but the analysis of cumulative impacts is not presented until Chapter 6.

As presented in the following analysis, mining would not severely interfere with the future usability of the region's or Nation's resources. The use of some resources, such as soils and vegetation for

example, would be decreased on the permit area for the 42-year life of the mine and into at least a portion of the reclamation evaluation period. However, the permit area would support the main land uses of the region, grazing and wildlife habitat with some dryland cropping, after reclamation is completed.

Table 4-1. Summary of Impact Analysis for the Proposed Action and No Action Alternatives

Impact Topic by Environmental Resource	Significance or Magnitude and Duration of Impact	
	Proposed Action Alternative	No Action Alternative
GEOLOGY AND MINERAL RESOURCES		
Remove and replace topsoil, overburden and coal, replace topsoil and overburden.	Insignificant; affects all horizons above base of coal within lease boundaries; major; long-term	No impact
TOPOGRAPHY		
Reduce slopes on area affected by mining.	Minor; long-term; affects all regional mines	No impact
SOILS		
Remove, mix and replace suitable topsoils; bury unsuitable soils.	Moderate; long term; affects all regional mines; insignificant	No impact
VEGETATION		
Reduction in vegetation diversity after reclamation.	Moderate short-term; minor long-term; affects all regional mines; insignificant	No impact
WATER RESOURCES		
Reduction in streamflows due to water captured in mandated sedimentation ponds.	Minor; short-term	No impact
Lowering of water levels in surrounding aquifers.	Minor due to requirements for replacing damaged water supplies; long-term over a region extending well beyond the mine boundaries.	No impact
Replacement of coal and overburden aquifers with a spoil aquifer.	Insignificant during mining since need for this water is removed by mining. Moderate long-term since alternative sources must be used until spoil aquifer reaches equilibrium.	No impact
ALLUVIAL VALLEY FLOORS		
While a final determination has not been made by WDEQ/LQD, it is believed that there are no AVFs on the proposed permit area.	No impact	No impact
FISH AND WILDLIFE		
Reduction in deer habitat; increase in road kills due to increased traffic.	Minor; short term on the mine site and in entire region	No impact
Reduction in pronghorn habitat.	Minor; short term on the mine site; moderate; short term in entire region	No impact
Removal of at least five active raptor nests and reduction of raptor habitat.	Moderate; short term on the mine site and entire region	No impact
Removal of two potentially active sage grouse leks.	Major if the leks are active, otherwise moderate; long-term until habitat is reestablished on the mine sites	No impact
T & E species	Moderate short-term for species which potentially breed in the area	No impact
Loss of nesting habitat or foraging areas for certain MBHFI.	Minor to moderate; short term; on the mine sites	No impact
Loss of habitat for predators and small mammals.	Minor to moderate; short term; on the mine site	No impact

Table 4-1. Summary of Impact Analysis for the Proposed Action and No Action Alternatives (cont.)

Impact Topic by Environmental Resource	Significance or Magnitude and Duration of Impact	
	Proposed Action Alternative	No Action Alternative
CULTURAL RESOURCES		
At least 9 sites believed eligible for NRHP are in the area to be disturbed and must be mitigated or the area cannot be affected.	Impacts to cultural resources are not permitted; at least 9 sites would be mitigated through data recovery.	No impact
PALEONTOLOGICAL RESOURCES		
Overburden excavation could potentially expose fossils for scientific examination.	Significance and magnitude would depend on rarity and condition of any discoveries; short term; on the mine sites	No impact
RECREATION		
The area disturbed at any one time would be unavailable for hunting.	Insignificant on mine site; area is privately controlled and could be removed from hunting at any time. Moderate for region during mining since herd levels can exceed target values	No impact
Wildlife viewing from Highway 59 would be curtailed for the disturbed areas.	Minor; short term; on the mine site	No impact
AIR QUALITY		
Airborne particulates would increase but would remain within State and Federal Standards.	Moderate inside permit boundary; minor within 5 miles of permit boundary; negligible beyond 5 miles; short term	No impact
VISUAL RESOURCES		
Reduction from Class IV to Class V due to construction of high-profile structures and large stockpiles.	Major for nearby residents and travelers on local public roads; short term; on mine site and adjacent areas.	No impact
NOISE		
Increased noise levels for nearby residents.	Minor to moderate within 1.9 miles of active mine areas; short term	No impact
TRANSPORTATION		
Increased number of unit trains to haul coal from the Rocky Butte Mine.	Minor (10 percent increase); short term	No impact
Increased traffic on roads and highways due to mine employees.	Minor over most of the region, possibly moderate for short reaches of Highway 59 and Four Corners Road; short term	No impact
LAND USE AND OWNERSHIP		
Loss of agricultural productivity for disturbed lands.	Negligible impact on agricultural productivity of region; short term	No impact
Loss of occupied dwellings on mine site.	Major impact to individual homes, minor significant since owners have agreed to relocate; long term	No impact
SOCIOECONOMICS		
Additional payroll of about $18 million per year.	Moderate; short term; affects entire county	Negative impact
Average increase in retail and service trade of about $12 million per year.	Moderate; short term; affects entire county	Negative impact
Population increase of 1,300 in Gillette and 1,500 in Campbell County.	Moderate; short term	Negative impact
Increased need for public facilities and services.	Minor; short term	Negative impact

Table 4-1. Summary of Impact Analysis for the Proposed Action and No Action Alternatives (cont.)

Impact Topic by Environmental Resource	Significance or Magnitude and Duration of Impact	
	Proposed Action Alternative	No Action Alternative
Revenues from royalties and taxes to the Federal government would total $656.6 million.	Moderate; short term	Negative impact
Revenues from royalties and taxes to the State government would total $418.1 million.	Moderate; short term	Negative impact
City of Gillette would receive sales and use tax revenues averaging $200,000 per year. Local revenues would total $146.9 million.	Moderate; short term	Negative impact

4.1 Environmental Impacts of the Proposed Action

4.1.1 Geology and Mineral Resources

Approximately 2.6 billion cubic yards of sedimentary deposits, including topsoil, overburden and coal, would be disturbed over the life of the mine. With the exception of the coal, these materials would be backfilled into the resulting open cut. The natural lateral continuity of individual lithologic units in the overburden would be lost due to disruption by the mining process.

Compaction structures in the coal-bearing formations such as those which have allowed gas in the coal seam to vent at the surface near Rawhide Village (Law, 1976) have not been identified in the Rocky Butte area. In the absence of such structures, and because there are no reported gas vents in the immediate vicinity, it is unlikely that the situation that occurred at Rawhide Village could be repeated in the subdivisions near the Rocky Butte Mine.

NWR would handle approximately 1.956 billion bcy of overburden in the course of mining. According to Dollhopf and others (1978), most unsuitable overburden disturbed by mining and reclamation activities is diluted as a matter of course, because it is mixed with suitable overburden in the spoil. After regrading and contouring, some spoil may still remain unsuitable for use in reclamation; this spoil would be characterized by high-clay texture, excessive acid-base potential, excessive nitrate-nitrogen concentrations, and selenium. NWR would bury the most undesirable spoil below the vegetation rooting zone, away from ground-water postmining phreatic surface, and outside the area of drainage channels or their floodplains. Sufficient suitable overburden material is available to place at least 4 feet of this material at the surface prior to replacing the topsoil. With 4.3 feet of topsoil available, this means that the top 8.3 feet of regraded surface materials will meet Wyoming DEQ/LQD suitability guidelines.

It is concluded that the impact of unsuitable overburden at the proposed Rocky Butte Mine on revegetation success and ground-water quality would be insignificant over the long term. Any overburden unsuitability issues can be resolved during the mine permitting process.

Currently producing oil wells are present within the permit area (see the "Land Use" section of Chapter 3 for their locations). Comparison of the mine sequence with the planned production schedule of these wells indicates that all the wells will have ceased production by the time they are encountered by the pit. If they are still producing when encountered by the mine, these wells would be capped below the lowest coal seam and mined through. The oil-and-gas production zone underlying the proposed permit area occurs in the Muddy Sandstone, which is over 6,000 feet below the lowest coal seam to be mined, and from the Minnelusa sandstone, which is about 9,500 feet below the coal. Given the depth of these production zones, no damage to future oil-and-gas production would occur as a result of mining.

It is concluded that the impact of the proposed Rocky Butte Mine on geology and minerals other than coal within the proposed permit area would be insignificant. Geology from the base of coal to the

surface would be subjected to a minor, long-term change, but there are no significant environmental impacts associated with this change.

4.1.2 Topography

Approximately 7,333 acres would be disturbed by mining and mining-related operations at the proposed Rocky Butte mine. The result of these operations would be that the final postmining elevation would average about 35 feet lower than premining elevation. The overall postmining topography would be slightly flatter than premining topography. Figure 4-1 shows a perspective view of the surface as it now exists, and Figure 4-2 shows the same view as it would appear at the conclusion of mining and reclamation.

Premining slopes average 2.3 percent, whereas the postmining slopes are expected to average 1.8 percent. The postmining slopes would range from 1 to 18 percent, thus maintaining some topographic diversity (Figure 4-2). The postmining surface has been designed by NWR to resemble the premining surface and restore surface drainage patterns.

The generally flatter topography that will result from mining and reclamation could have two beneficial impacts on the reclaimed land surface. First, a flatter land surface would allow for greater infiltration of precipitation, thereby increasing the viability of the postmining vegetation. Second, a flatter land surface could result in a reduction in erosion of reclaimed soils by surface runoff.

The postmining topography of the proposed Rocky Butte mine (Figure 4-2) shows a ridge approximately a mile long, located in the western third of the proposed mine area essentially where the premining ridge occurred, simulating the original premining topography. The approximate original drainage pattern will be restored with stock ponds and retention reservoirs replaced to provide for future livestock requirements. The reduction of overall postmining slopes should minimize erosion by runoff and may accelerate recharge of the local groundwater system following mine completion. It is concluded that the impacts of slightly flatter slopes and larger closed basins will be long-term and minor.

4.1.3 Soils

Construction and mining would progressively disturb topsoil on 7,333 acres during the life of the mine. Maximum annual surface disturbance would occur during the first two years of construction and mine development when 412 and 509 acres would be disturbed. After the sixth year, a cumulative total of about 1,497 acres would be disturbed. Reclamation would begin in the seventh year, and there would then be a progressive pattern of new disturbance and reclamation work each year. Throughout the remainder of the life of the mine, there would be about 1,850 acres of disturbed land, on which reclamation has not been initiated, at any given moment.

Impacts would result from the removal of topsoil and vegetation and from the handling of topsoil. Mining would disturb soil horizons and other soil characteristics that are the result of centuries of soil forming processes. Stockpiling topsoil for several years before it is redistributed would have negative effects on nutrient content, viability of plant seeds, and microbial activity in such topsoils. Some topsoil stockpiles would remain throughout the life of the mine. Erosion from both wind and water would increase on disturbed lands as compared to those same lands prior to disturbance.

Reclaimed soils would be unlike premining soils in texture, structure, color, organic matter content, and chemical composition due to mixing and storage. They would be more uniform in type, thickness, and texture than before disturbance. Dilution of the upper soil horizons by less fertile substratum material would decrease soil fertility. Subsoil material is also very low in organic matter, microbial activity, and major plant nutrients and may have undesirable physical composition. The destruction of soil aggregate structure would occur if heavy equipment was driven over moist soil during reclamation and would result in decreased permeability and infiltration. This would decrease air exchange rates and water holding capacity in the soils and would negatively affect vegetation production.

If all suitable topsoil from disturbed areas is salvaged and replaced uniformly over the disturbed area it would cover that area with about 4.3 feet of topsoil. This would be more than adequate to

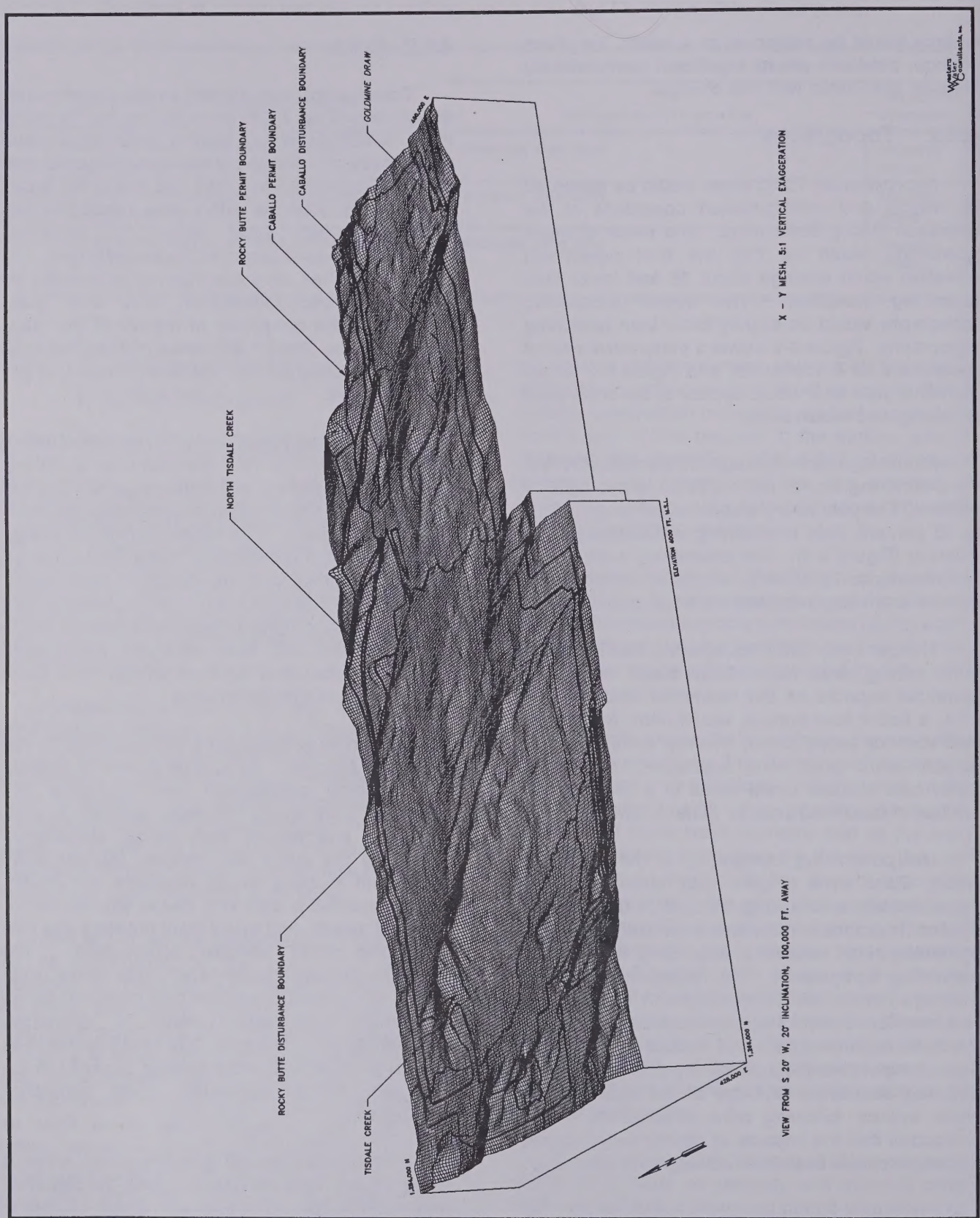

ROCKY BUTTE PERMIT BOUNDARY
CABALLO PERMIT BOUNDARY
CABALLO DISTURBANCE BOUNDARY
GOLDMINE DRAW
NORTH TISDALE CREEK
ROCKY BUTTE DISTURBANCE BOUNDARY
TISDALE CREEK
ELEVATION 4000 FT. M.S.L.
X - Y MESH, 5:1 VERTICAL EXAGGERATION
VIEW FROM S 20° W, 20° INCLINATION, 100,000 FT. AWAY

Figure 4-1. Premining 3-Dimensional Perspective View of Rocky Butte Mine Area

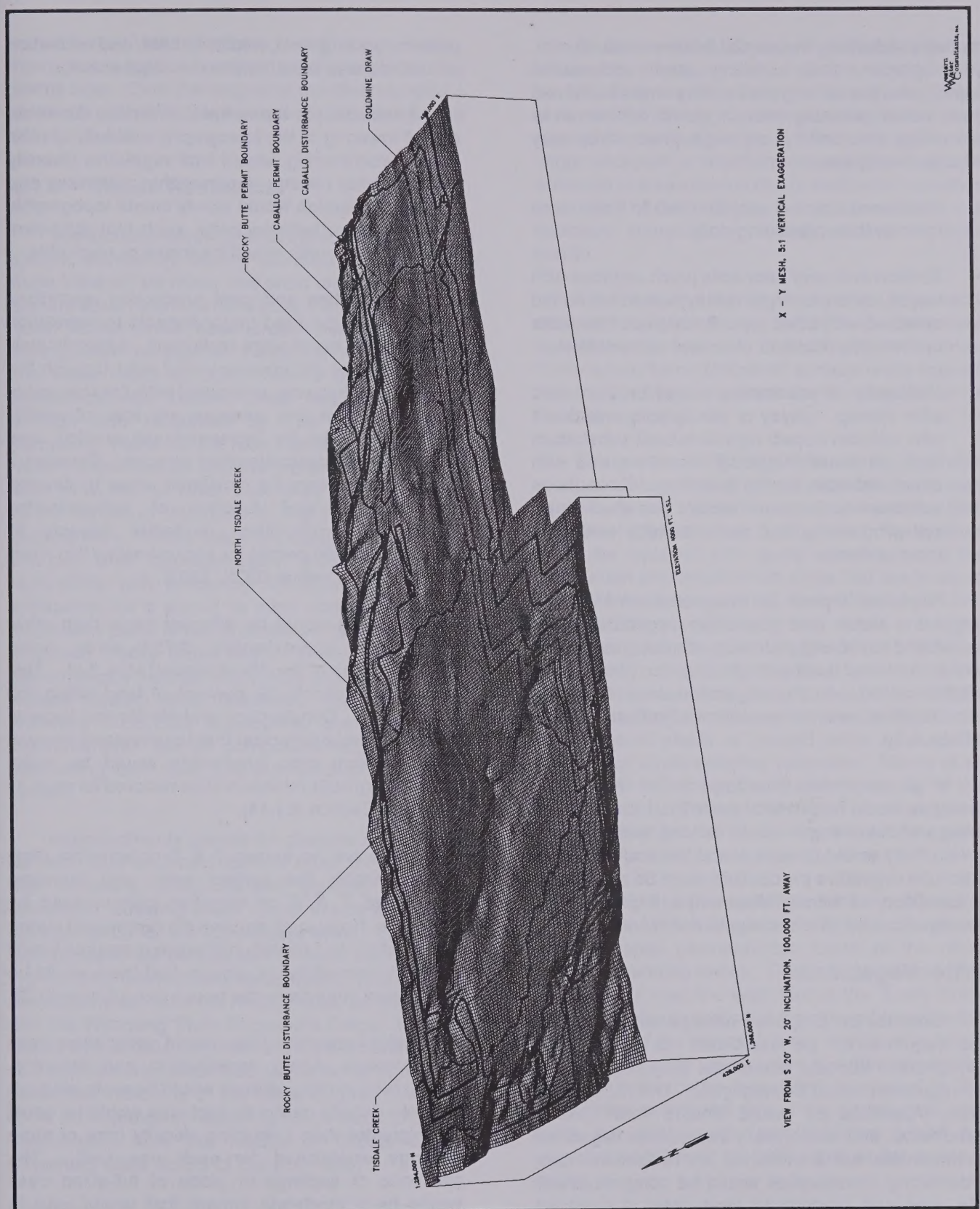

ROCKY BUTTE PERMIT BOUNDARY
CABALLO PERMIT BOUNDARY
CABALLO DISTURBANCE BOUNDARY
GOLDMINE DRAW
NORTH TISDALE CREEK
ROCKY BUTTE DISTURBANCE BOUNDARY
TISDALE CREEK
X - Y MESH, 5:1 VERTICAL EXAGGERATION
VIEW FROM S 20° W, 20° INCLINATION, 100,000 FT. AWAY

Figure 4-2. Postmining 3-Dimensional Perspective View of Rocky Butte Mine Area

restore productivity from a soil thickness standpoint. With proper soil handling and reclamation techniques, postmining productivity on the reclaimed area would probably remain about the same as premining productivity, although productivity may change locally because:

- Reclaimed topsoil depths would be more uniform than premining soils.

- Shallow soils and poor soils (such as those with clayey texture or high salinity) would be buried or mixed with other topsoil materials to a more uniform physical and chemical composition.

- Uniformity of soil texture would be increased after mining: clayey or sandy soils and those with well-developed topsoil-subsoil substratum horizons would inevitably become mixed with other materials during handling. Once these soils were redistributed across disturbed areas, soil productivity and soil erodibility would be more uniform.

Replaced topsoil in the permit area should support a stable and productive vegetative cover capable of sustaining planned postmining land uses, which include livestock grazing, cropland, and wildlife habitat. As the vegetation cover becomes reestablished, erosion would not significantly affect productivity.

It is concluded that impacts to the topsoil resource would be moderate, confined to the permit area, and the changes would be long term although productivity would be restored at the end of mining. Because vegetative productivity must be restored as a condition of bond release, the impact of the changes to topsoil is not significant.

4.1.4 Vegetation

Because the proposed mine permit area would be required to be reclaimed to meet state revegetation success standards, long-term impacts to vegetation would be negligible. The reclamation plan (Appendix B) would ensure that diverse, productive, and ecologically sustainable vegetation communities are established on reclaimed areas. Postmining communities would be compatible with the proposed postmining land uses of cropland, pasture, grazing land, wildlife habitat, and recreation and would also meet landowner requirements.

A reduction in topographic diversity, due to an overall lowering of the topography and loss of relief during recontouring, would limit vegetative diversity for years after mining. Geomorphic processes and natural succession would slowly create topographic and vegetative heterogeneity, such that long-term impacts to diversity would be minor or negligible.

Construction and coal production operations would cause localized major impacts to vegetation until affected areas were reclaimed. Approximately 1,850 acres of disturbance would exist through the life-of-mine. Impacts associated with the removal of vegetation over this acreage are loss of wildlife habitat, potential for increased soil erosion, and invasion by undesirable plant species. Because it takes several years for reclaimed areas to develop the structure and function of self-sustaining vegetation communities, moderate impacts to vegetation would persist for approximately five years following reclamation (SCS, 1982).

Cropland would be affected more than other types, with approximately 3,752 acres being disturbed during the life-of-mine (Table 3-2). This acreage represents 39 percent of land within the project area. Construction and life-of-mine impacts on agricultural production due to temporary removal of lands from crop production would be minor because agricultural uses will be restored as soon as practical (Section 4.1.14).

There are no known T & E or sensitive plant species within the project area, and therefore impacts to T & E or sensitive plants would be negligible. If any such species are discovered during construction and mining, mitigation measures would be taken immediately to ensure that there would be no adverse impacts to the population (Appendix D).

Major impacts to trees would occur when trees are removed during construction and stripping. During reclamation, all trees would be replaced such that tree density on the project area would be equal to or greater than premining density (one or more saplings established for each tree lost). The presence of saplings in place of full-sized trees would be a moderate impact that would exist in localized areas throughout the life-of-mine.

It is concluded that there would be a moderate, short-term reduction in vegetation diversity within the permit area. Over the long term the diversity will be restored, such that the impacts of this change are not significant.

4.1.5 Water Resources

The incremental impacts to the surface drainage system caused by mining activities at the Rocky Butte Mine will be minor and short term. Two of the primary streams on the mine area, Tisdale Creek and North Tisdale Creek, have already been affected by mining within the adjacent Caballo Mine permit area. The lower reach of North Tisdale Creek near its confluence with Tisdale Creek has been mined through and reclaimed by The Carter Mining Company. Plans for the reclamation of Tisdale and North Tisdale Creeks and the protection of the Gold Mine Draw alluvial valley floor have been approved by the Wyoming DEQ/LQD during permitting of the Caballo Mine. These plans are designed to provide channel and drainage-basin erosional stability compatible with premining conditions. A formal application for a permit to mine containing similar restoration plans is being prepared by NWR for the proposed Rocky Butte Mine. These reclamation plans typically include postmining impoundments to replace existing stock reservoirs. As required by Wyoming DEQ/LQD regulations, the postmining impoundments will be compatible with proposed postmining land uses and the restored hydrologic system.

Impoundments placed on streams and utilized for flood and sediment control must be permitted with Wyoming DEQ/LQD and typically must be dewatered following major runoff events to provide storage space for the subsequent event. The water thus released will be available to meet the needs of any existing downstream water users. Additionally, impoundments used for mining must be permitted with the Wyoming State Engineer's Office. Permits issued by the State Engineer's office are conditioned and administered such that senior water rights are protected. Records of the State Engineer's Office show no adjudicated water rights on Caballo Creek downstream from the mouth of Tisdale Creek (Wyoming State Board of Control, 1963).

Surface water quality would not be significantly affected by mining, based on studies conducted by the USGS for the Belle Fourche River Basin (Bloyd, et al., 1986). Although reclaimed soils may be more erosive for the first few years after reclamation, the larger sediment production would probably not be delivered to area streams due to sediment deposition as a result of flatter slopes on reclaimed lands and sediment trapping by mandated sedimentation ponds.

It is concluded that the Rocky Butte Mine would cause a minor, short-term reduction in streamflows due to water captured in sedimentation ponds. There would be no long-term surface water impacts due to regulatory requirements for rehabilitation of the drainage system.

The proposed Rocky Butte mining operation would completely remove the Wyodak-Anderson coal aquifer and any Wasatch overburden aquifers from an area of approximately 5,300 acres. The aquifers would be replaced with spoils whose origin is the overburden and interburden strata that are stripped away with the removal of the coal. The physical and chemical characteristics of mine spoils are highly dependent upon the parent material from which they are derived. Data collected thus far from Powder River Basin area mines show that once resaturated with ground water, mine spoils are usually able to provide small yields of ground water of a quality suitable for stock watering purposes. Martin et al. (1988) concluded that the final permeability of the mine spoils will likely be within the range of permeabilities for the undisturbed Wasatch aquifer and the Wyodak-Anderson coal aquifer.

Overall, the permeability of the spoils at the Rocky Butte Mine is expected to fall within the broad range of spoil permeabilities found at the other regional operating mines. The average permeability of the spoils over the west half of the Rocky Butte Mine would be expected to be skewed towards the higher end of the regional range of values because the overburden in these areas is especially sandy. There appears to be somewhat less sand in the overburden of the east half of the permit area, and there the final spoils permeabilities would be expected to fall near the lower limit of the regional values.

Considerable variability does exist in the replaced spoil, as is evidenced by the fact that spoil permeabilites vary by three orders of magnitude at the Gillette area mines. This variability is partially due to the extreme differences in the textures of the overburden materials. Another factor causing hydraulic variability in spoils is the degree to which the spoils are mechanically sorted during backfilling. The mechanical sorting is the process by which large spoil fragments tend to roll farthest down the backfill bench where they accumulate at the bottom of the replaced spoil sequence. The sorting is most pronounced in dragline-cast spoils but is also observed in truck-dumped spoils. In truck-shovel spoils, overall permeabilities are generally lower than dragline spoils because the vehicular traffic of the truck-shovel emplacement causes some spoil compaction. The Rocky Butte Mine will be a combined truck-shovel/dragline operation, with approximately the lower half of the overburden removed by dragline. The product of the mechanical sorting is a spoil aquifer whose porosity and permeability decrease upwards from the pit floor.

Additional variability in spoil hydraulics exists because the geologic strata of the overburden are not completely mixed by the spoil placement process. The spoils would probably contain small zones of higher-permeability sands within a matrix of finer-grained material, similar to the sandstone channels contained in the premining Wasatch overburden.

The types of water that have been observed in resaturated spoils are chemically similar to those found in the premining Wasatch. However, the total dissolved solids (TDS) concentrations of the postmining ground waters are occasionally much larger than is found in the undisturbed Wasatch or Wyodak-Anderson coal aquifers. Ground waters that initially saturate replaced spoils have relatively high TDS concentrations derived from the dissolution of minerals exposed by the breaking up of the spoil materials in the mining and backfilling processes. At the Caballo Mine, average TDS concentrations in spoil ground waters were initially about 4,630 mg/L for the first two years after spoil emplacement, but they declined to 3,750 mg/L four years after spoil emplacement (TCMC, 1985). Some of the principal solutes of concern in these spoil ground waters include sulfate, nitrate and selenium. At other Gillette area mines the average TDS values in spoil ground waters have ranged from 700 to 25,000 mg/L (GAGMO, 1991a). Most spoil wells exhibit TDS values between 3,000 and 6,000 mg/L and, similar to the premining Wasatch aquifer, meet Wyoming Class III standards for use as stock water. The principal cations in the postmining ground waters are typically calcium, magnesium and sodium, while the predominant anions are sulfate and bicarbonate. Similar to the Caballo Mine, a number of other Gillette area mines have noted that TDS concentrations in their spoil ground waters have declined with time. Using data compiled from ten surface coal mines in the eastern Powder River Basin, Martin et al. (1988) concluded that spoil ground water quality improves markedly after the spoils are leached with one pore volume of water. One pore volume of water is the volume of water which would be required to fill the pore space or saturate the spoils following reclamation. Future postmining ground waters are therefore expected to be of better quality than what is observed today.

There are approximately 53 private water supply wells lying within 5,000 feet of the boundary within which blasting will occur over the life of the proposed Rocky Butte Mine. The closest private well lies some 1,400 feet west of the overburden removal boundary (approximate blasting boundary) of the proposed mine. Within this area the maximum allowable peak particle velocity for ground vibration from surface coal mine blasting is 1.00 inch per second (WDEQ/LQD, 1989). In the coal fields of the eastern United States and in the Powder River Basin as well, there have been occasional instances where water well owners in such close proximity to operating strip mines have complained about the effects of blasting on the performance of their water wells. There is little published data pertaining directly to effects of blasting on wells or ground-water aquifers, and among the documented complaints there has been very little clear evidence that the well problems were blast related. In their studies of complaints of blast damaged wells in Appalachia, Philip Berger and Associates, Inc. (1980, 1982) concluded that natural factors and poor well design and construction practices were most often the factors responsible for changes in well behavior in blasting complaint cases. The authors based their studies on private wells and on a number of test control wells located at operating coal strip mine pits. The authors reported no observable change in well conditions in their tests, even though the maximum ground vibration

levels at the wells from blasting were as great as 5.4 inches per second. The 53 private wells that are in close proximity to the Rocky Butte Mine are not expected to be damaged by blasting vibrations. In keeping with the Rules and Regulations of the Wyoming DEQ/LQD (1989), owners of property lying within one-half mile of the Rocky Butte permit boundary are entitled to a pre-blasting survey that includes documentation of the performance and condition of water wells.

Impacts to the sub-coal Fort Union (Tullock) sand aquifers will be limited to drawdown induced by withdrawals from wells. At this time NWR does not plan to complete a well in these sands unless mine water requirements cannot be met by near-surface sources. Under this plan, no impacts to the sub-coal sands would result from the Rocky Butte Mine.

NWR has operated a computer ground-water flow model of the coal and overburden in order to predict the magnitude and extent of drawdowns outside the permit area. The USGS computer model MODFLOW (McDonald and Harbaugh, 1988) was used in this analysis. This model simulates a three-dimensional, multi-layer system such as the coal/overburden complex using a set of finite-difference equations which describe ground-water flow. Vertical leakance between layers is simulated as are discharge and recharge sources.

Approximately 1,160 square miles are included in the modeled area which is shown on Figures 3-4 and 3-5. In order to simulate cumulative coal and overburden water level drawdowns, mining was simulated at the six closest surrounding mine sites in addition to proposed mining at Rocky Butte. Mining was simulated for the Wyodak, Caballo, Belle Ayr, Rojo Caballo, Cordero, and Coal Creek Mines. The permit areas for these operations are shown on Figures 3-4 and 3-5.

Model calibration was verified by comparing predicted 1990 drawdown in the Wyodak-Anderson coal seam to the five-foot drawdown contour reported by the Gillette Area Groundwater Monitoring Organization in its 10-Year Report (Hydro-Engineering, 1991b). This comparison is presented graphically on Figure 4-3. Making this comparison reveals very close agreement between predicted and observed drawdown in the Wyodak-Anderson coal seam. In general, the model is conservative since drawdown is slightly over-estimated in most areas. This over-estimation is probably due to local faults, partings and no-coal zones present in the Wyodak-Anderson coal seam but not simulated in the model due to lack of data outside the mine permit area. Geologic features of this type tend to lower the transmissivity of the coal on a regional scale.

No regional drawdown data is available for the overburden. For this reason, and since the modeled overburden drawdown is of much smaller extent than that in the coal, no attempt was made to compare the model-predicted drawdowns to the observed drawdowns for the overburden.

NWR operated its predictive model to simulate mining at each of the six mines mentioned above while excluding the proposed operations at Rocky Butte. The predicted extent of drawdown for this situation as represented by five-foot drawdown contours in the coal and overburden are presented on Figure 4-4.

The procedure was repeated with the Rocky Butte Mine included. The resulting five-foot drawdown contour for both the Wyodak-Anderson coal seam and the Wasatch overburden is presented on Figure 4-5. By comparing this figure to Figure 4-4, the approximate impacts due to the proposed Rocky Butte operation alone can be determined. Figure 4-4 can be considered the expected drawdown under the No Action Alternative for this EIS. For purposes of comparison, the five-foot drawdown contour predicted by the USGS in its CHIA study (Martin et al., 1988) of the Powder River Basin is also presented on Figures 4-4 and 4-5. With or without the Rocky Butte Mine, the extent of the 5-foot drawdown contour is similar to or less than the maximum extent shown in the CHIA.

As a requirement to obtain a permit to mine, the applicant must compile a list of all water rights within three miles of the permit area. One hundred fourteen wells recorded with the Wyoming State Engineer in this area have reported completions in the overburden. An additional 24 permitted wells are reportedly completed in the Wyodak-Anderson coal within this limit. Coal wells lying within one mile of the permit area would undergo significant drawdowns possibly to the point of complete dewatering near the pit limits. Similarly, the

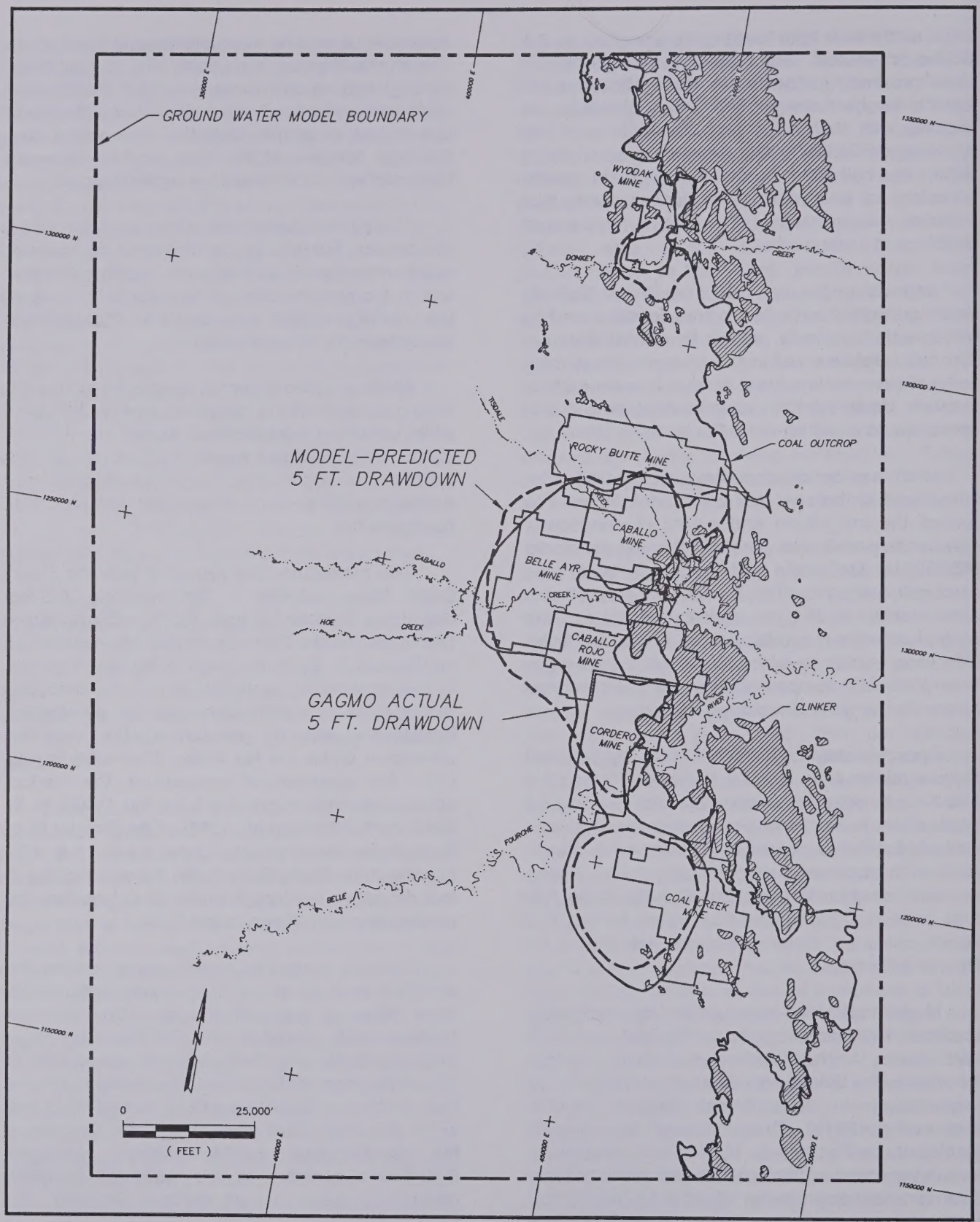


Figure 4-3. Predicted Drawdowns vs. Actual Drawdowns in the Wyodak-Anderson Coal at the End of 1990

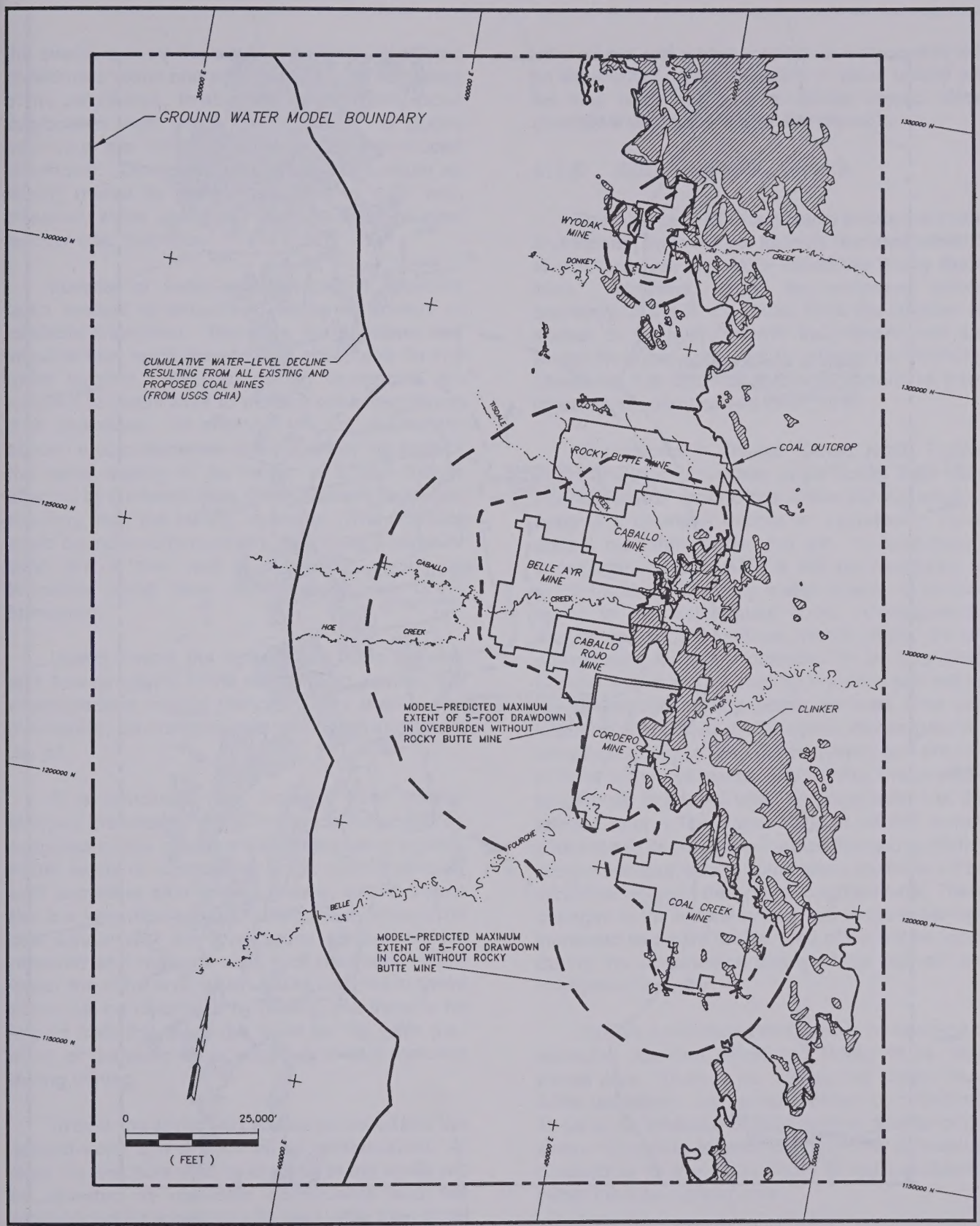


Figure 4-4. Model-Predicted Maximum Extent of Drawdown in Coal and Overburden Without Rocky Butte Mine

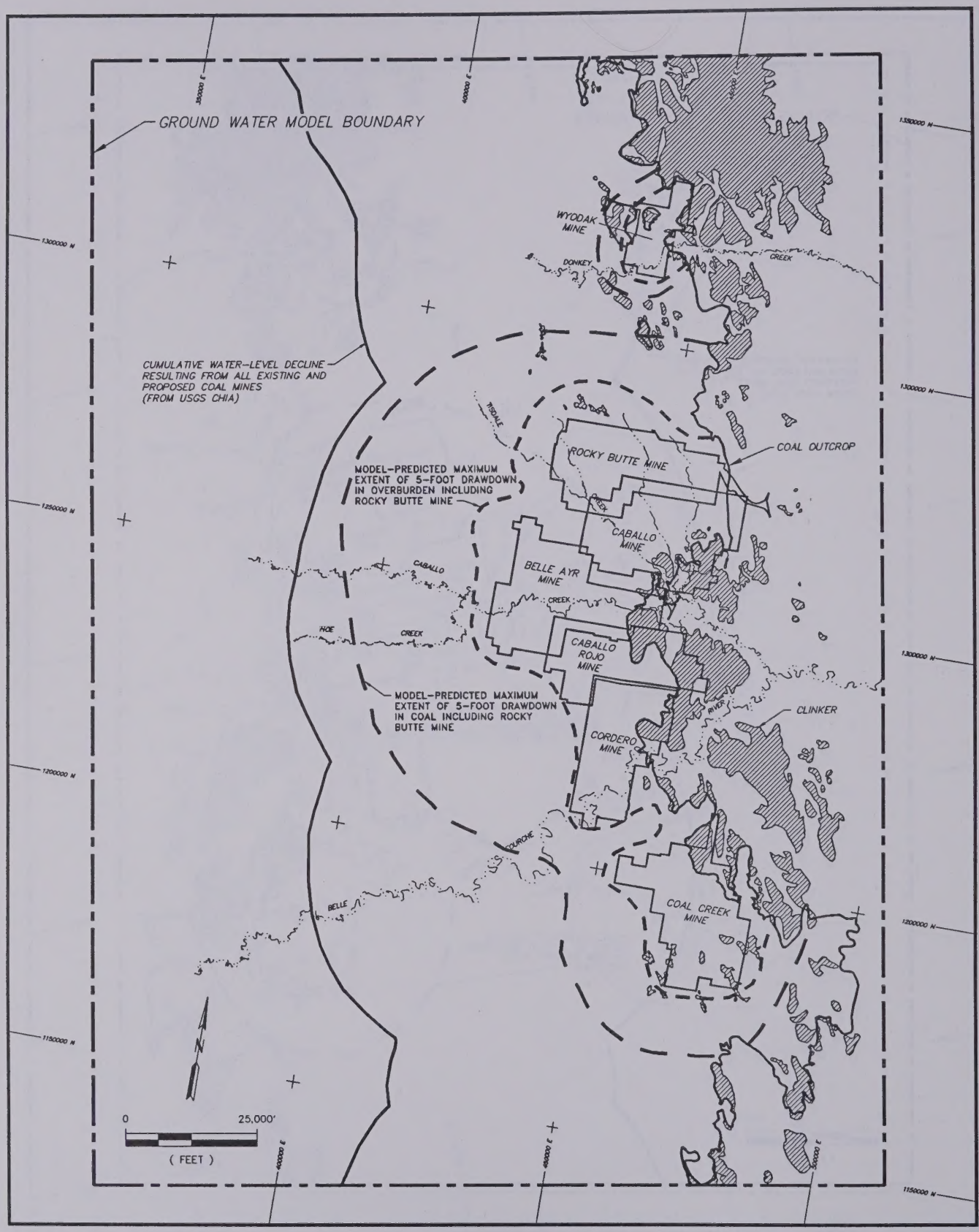


Figure 4-5. Model-Predicted Maximum Extent of Drawdowns in Coal and Overburden With Rocky Butte Mine

the overburden aquifer would experience significant drawdowns within one mile due west and northwest of the permit area. In all other directions only those overburden wells within 2,000 feet of the permit boundary are likely to observe mining-induced drawdown. Drawdowns will reach a maximum as mining makes its closest approach to each well. However, water levels will likely stabilize or even recover after that time.

Severity of water-level drawdowns depends upon amount of drawdown relative to amount of available drawdown. There are no guidelines that stipulate how much drawdown is acceptable for any given location. All coal mining companies are required to install wells to monitor drawdowns from their operations. All mining PAPs are required to contain a commitment that the operator will replace the water supply of an owner of a well that is affected by contamination, diminution or interruption resulting from the mining operation. The operator could be required to deepen a well, lower a pump or even drill a new well in a deeper, underlying formation (most likely the sub-coal Fort Union formation).

During mining, the mine pit acts like a big well, and flow directions in the surrounding aquifers are down-gradient toward the pit. Thus there is no mechanism for contaminants to migrate away from the pit.

It is concluded that impacts from mining-induced drawdowns are minor since they must be mitigated by the operator if a water user is injured. Water levels in surrounding areas will not recover until sometime after mining ceases, and therefore this is a long-term impact. Within the mine area the coal aquifer and any overburden aquifers will be removed and replaced with spoil materials. Wells within the mine area which are completed in these zones will be destroyed by mining, but there is no impact from this since the need for the wells (i.e., stock or domestic water supplies) is also removed during mining.

In time, the spoils will become saturated and the ground-water flow system will be reestablished. At least the first pore volume of water in the spoils will be elevated in dissolved constituents and will probably not be acceptable for uses other than stock water. In time, the soluble constituents will be leached out and a new equilibrium water quality will be established. This reduction in water quality will be long term but is a moderate impact since alternative sources of water are available.

4.1.6 Alluvial Valley Floors

The mine permitting regulatory authorities (state and federal) have not yet formally declared whether or not there are any AVFs within the Rocky Butte Mine. However, within the proposed permit boundary of the Rocky Butte Mine the streams all appear to be hydrologically insignificant and are similar to areas approved for mining downstream. Therefore, it is doubtful that any portions of them meet the statutory criteria of an AVF.

Streamflows in Tisdale Creek, North Tisdale Creek and Gold Mine Draw at the Rocky Butte Mine will be diverted around the active mining areas in temporary diversion ditches or captured in flood-control reservoirs above the pit. If flood-control impoundments are used, it will be necessary to evacuate them following major events to provide space for the subsequent flood. Consequently, disruptions to streamflows which might supply downstream AVFs are expected to be negligible. Ground waters intercepted by the mine pits will be routed through settling ponds to meet state and federal quality criteria, and the pond discharges may actually slightly increase the frequency and amount of flows in these streams. Dry Donkey Creek will be temporarily impacted with the construction of the railroad spur. The upper reaches of this stream channel and its tributaries may be diverted in ditches around the spur, and in some areas the flows will be conveyed beneath the spur through culverts. These changes to the natural system will cause temporary increased sediment yields. The effect will be minor during the construction phase of the railroad and negligible thereafter.

Studies have shown that there is an absence of saturated alluvium within the Rocky Butte Mine permit area. There is no evidence of stream base flows sustained by ground-water contributions. There is no evidence of subirrigation outside of the stream channels themselves, and the agricultural productivity of the valley floors is not significantly better than the upland areas.

It is concluded that no AVFs will be impacted by the Rocky Butte Mine pending a final determination by Wyoming DEQ/LQD.

4.1.7 Fish and Wildlife

Although 27 of the approximately 35 ponds and all ephemeral drainages occurring on the project area would be temporarily removed and/or relocated during the life of the mine, no impacts to fisheries are anticipated from the proposed mining operation because no known fisheries exist on the area.

Approximately 3,165 acres of native habitat (i.e., 2,154 acres sagebrush, 959 acres grassland, and 52 acres riparian) and 3,752 acres of cropland (primarily hay species), the primary habitats used by pronghorn antelope and mule deer on the project area, would be disturbed during the life of mine (Table 4-2). This represents 1.1 percent of the 650,000 acres of pronghorn habitat and 0.2 percent of the 1,968,000 acres of mule deer habitat in the Hilight and Thunder Basin herds, respectively. Additionally, topographic moderation may reduce habitat diversity. Reclamation, including the establishment of palatable forage species, would begin approximately six years after project initiation (Appendix B), allowing no more than about 1,850 acres to remain disturbed at any one time over the life of the mine. Young grasses, forbs, and shrubs present on the newly reclaimed areas would provide forage for antelope and mule deer while mining operations continue elsewhere on the area.

Since no crucial habitat for the Hilight pronghorn antelope herd and Thunder Basin mule deer herd exists within the project area and herd populations are near current WGFD objectives, impacts to antelope and mule deer populations resulting from the proposed project would be minor. Greater mortality would likely result from increased road kills due to increased traffic levels. Animals in the disturbed areas would likely be temporarily displaced to suitable habitats adjacent to operations for the life of the mine. Minor impacts are also anticipated for antelope and mule deer in the Pumpkin Buttes herds due to increased competition caused by displaced animals moving off the project area.

Impacts to white-tailed deer are expected to be minor over the life of the mine since no WGFD designated white-tailed deer range exists on the project area, and only 52 acres of riparian habitat (i.e., habitat in which white-tailed deer were most frequently observed) is present (Table 4-2). Those white-tails that do occur on the area would likely be displaced to suitable habitats adjacent to operations. White-tailed deer may utilize newly reclaimed riparian areas as such areas are established (Appendix B). Minimal increases in mortality (i.e., road kills) resulting from increased traffic may occur as a result of the proposed operation.

Impacts to raptors resulting from the proposed project would be moderate in intensity and remain for the life of the mine. Six raptor nests would be removed within the disturbed area (Table 4-2), five of which were active in 1991. Four additional nests within 0.25 mile of the project area may also be unsuitable for use by some raptor species; however, species such as golden eagle are known to be tolerant of mining operations as shown by their nesting on highwalls within active pits (Mariah Associates, Inc., 1988a, 1988b). Increased mortality of raptors may also result from traffic fatalities and/or power line electrocutions and collisions. Mitigation measures have been designed to minimize these hazards (Appendix D).

Approximately 1,850 acres (Table 2-1) would, at any point in time, be unavailable as hunting and foraging habitat for some raptors (Table 4-2); however, many raptors will continue to use areas of active mining (Phillips and Beske, 1990). As lands are reclaimed and small mammals and birds reinvade these areas, greater numbers of hunting and foraging raptors would be expected to again utilize these sites. Mitigation measures designed to lessen impacts to raptors (e.g., raptor monitoring plan [Appendix D]) would reduce negative impacts resulting from the proposed project.

The proposed mining activity could have major, long term impacts to sage grouse on the project area if the two historic sage grouse leks occurring on the project area are determined to be active (Table 4-2), since these leks would be destroyed by mining activities. Studies conducted in 1979 and 1980 on western and northeastern portions of the project area indicated that the two historic leks on the project area, as well as the historic lek occurring within the two-mile buffer (Figure 3-8), were not active (Harner-White Ecological Consultants, 1980). Additionally,

breeding birds have been known to relocate if leks are disturbed and other suitable habitat exists nearby. If leks are inactive, project impacts to sage grouse would be moderate and last until sagebrush becomes reestablished (Appendix B). These impacts would result primarily from the loss of nesting and foraging habitat. Some additional mortality may also result from traffic accidents; however, mitigation designed to reduce these impacts would keep fatalities at minimal levels (Appendix D).

No impacts are anticipated for sharp-tail grouse since they have not been observed on the project area. Impacts to mourning dove are expected to be minor since their numbers are relatively low and sufficient suitable habitat for the species exists outside the project area. Dove utilization of shelterbelts and other sites with trees on the project area would be interrupted until trees become reestablished on the area (approximately 10 to 20 years).

Table 4-2. Acreage of Life of Mine Disturbance Within Wildlife Habitats on the Proposed Rocky Butte Mine, Campbell County, Wyoming, 1991.

Species	Total Occupied Area (Acres)	Area of Occupied Habitats on the Project Area (Acres)	Acreage of Disturbance Within Occupied Habitats on the Project Area (Acres)	Percent of Habitat Loss on the Project Area[9]	Percent of Habitat Loss Within Area of Occupancy[9]
Pronghorn Antelope	650,200[1]	8,958[2]	6,917	77.2	1.1
Mule Deer	1,968,000[3]	5,555[2]	4,269	76.8	0.2
White-tailed Deer	332,900[4]	66[5]	52	78.8	<0.1
Raptors	45,120[6]	9,647[7]	7,333	76.0	16.3
number of nests	27	8	6	75.0	22.0
Sage Grouse	23,726[8]	5,996	4,347	72.5	18.3
number of leks	6	2	2	100.0	33.3

[1] Hilight herd unit.
[2] Includes native and cropland vegetation types.
[3] Thunder Basin herd unit.
[4] Thunder Basin herd unit and riparian habitat on project area.
[5] Includes riparian vegetation.
[6] Includes project area and two mile buffer per WDEQ guidelines (1987).
[7] Includes entire project area.
[8] Area within two miles of lek centers on project area and two mile buffer.
[9] Maximum effect for life-of-mine.

Impacts to MBHFI vary from none for species not occurring on the area to moderate for nesting species. Impacts would result primarily from the loss of nesting and foraging habitat for the life of mine on no more than approximately 1,850 acres in any one year. Species which would likely be unaffected by the project are canvasback, whooping crane, Lewis' woodpecker, and dickcissel. MBHFI for which impacts could be minor (i.e., loss of foraging areas primarily during migrations) are white pelican, double-crested cormorant, bald eagle, osprey, American peregrine falcon, prairie falcon, Richardson's merlin, sandhill crane, mountain plover, and long-billed curlew. MBHFI for which impacts could be moderate (i.e., loss of nesting habitat) are ferruginous hawk, golden eagle, and burrowing owl.

Reclaimed areas would likely be used by most MBHFI foraging on the area soon after vegetation establishment, and additional mitigation designed for nesting species would further minimize impacts on these species. Increased mortality from traffic accidents (all MBHFI) could result from proposed activities, as could increased mortality from collisions (MBHFI raptors and cranes) and electrocutions (MBHFI raptors) resulting from powerlines.

Appendix D discusses mitigation designed to alleviate these potential problems.

No impacts are anticipated for black-footed ferret from the proposed Rocky Butte Mine since no suitable habitat for the species is present. Minor impacts for bald eagles could result from the loss of foraging habitat on the project area for eagles wintering at the Belle Fourche roost and for migrating peregrine falcon. These impacts would last only for the duration of mining operations; however, continuous reclamation of mined areas would make many areas available for hunting and foraging by these species prior to cessation of mining operations.

No impacts are anticipated for State sensitive wildlife species; there have been no recent reports of these species on the project area and adjacent two-mile buffer (personal communication, Robin Jones, Nature Conservancy, 1991). Impacts to WGFD priority bird species including burrowing owl, ferruginous hawk, mountain plover, and long-billed curlew have been discussed above. Mountain plover, a candidate species for federal T & E listing, has not been observed in the area (Oakleaf et. al. 1991), and the USFWS has not identified it as a concern (personal communication, Ron Starkey, 1991). Upland sandpiper, also identified as a priority species by the WGFD (personal communication, Sharon Ritter, 1991), may occasionally breed on the area and could be moderately impacted over the life of mine. Mitigation for T & E and State sensitive/priority species is discussed in Appendix D.

Impacts to other wildlife species occurring on the area range from minor for highly mobile species that do not breed in the area (e.g., coyote, migrating birds), to moderate for breeding species and relatively sedentary species (e.g., red fox, numerous small mammal species, breeding birds). Impacts would remain for the life of the project.

Predator species occurring on the project area would likely be displaced to suitable adjacent habitats during mining operations. Coyote and bobcat (i.e., nonbreeding species) would receive minor impacts, whereas red fox, badger, and striped skunk (i.e., breeding species) would receive moderate impacts. Increased mortality may result from increased competition for food in adjacent areas and increased mortality due to traffic.

Impacts to lagomorphs and other small mammals occurring on the area would also be moderate over the life of the mine, with increased mortality likely resulting during construction and mining operations and from increased road kills. Nongame birds and waterfowl known to breed on the project area would also suffer moderate impacts from the loss of nesting habitat for the life of the mine. As habitats are replaced these species can be expected to return to the area (Appendix B).

4.1.8 Historical, Archaeological, and Paleontological Resources

A total of 59 cultural resource sites have been inventoried within the Rocky Butte lease area and adjacent areas in which proposed developments may take place. These sites are about evenly divided between historic (26 sites) and prehistoric (29 sites); another four sites are multicomponent with both historic and prehistoric occupations.

Of the total, nine are believed eligible for the NRHP. Seven of these sites may be directly affected by the proposed undertaking. The affected sites include five prehistoric and two historic sites. The prehistoric sites include the probable Paleoindian complex (Sites 48CA2707, 48CA2708, and 48CA2723) which could prove to be quite important and one site (48CA472) that has been partially excavated (Hauff and Eckles 1982). Only the latter site, however, has been fully evaluated. All five sites potentially contain important excavation and research potential and are believed eligible under NRHP Criterion D. The two historic sites include an historically important road (Site 48CA2694) believed eligible under Criterion A and a twentieth century homestead/ranch (Site 48CA1974) believed eligible under Criterion A. The other known cultural resources are believed not to be significant.

The effects on the potentially eligible prehistoric and historic sites resulting from the proposed mine are complete destruction due to surface strip mining excavation and construction of the proposed railroad spur. These impacts would constitute adverse effects in the Section 106 process as defined by the Federal Criteria of Effect (36 CFR 800.8) and Criteria of Adverse Effect (36 CFR 800.9).

Impacts to cultural resources cannot be permitted. Sites which cannot be avoided must be mitigated in accordance with procedures discussed in Appendix D.

Potential impacts to paleontological resources consist of losses of vertebrate, invertebrate, and paleobotanical fossils of importance to scientific research. The losses would result from destruction, disturbance or removal of fossil materials as a result of coal mining activities, unauthorized collection, and vandalism. A positive impact of coal mining activities would be the exposure of fossils for scientific examination and collection which would otherwise not occur except as a result of overburden excavation and exposure of fossiliferous geologic strata.

No impacts to known significant paleontological resources are expected as a result of coal mining activities. However, there is potential for buried paleontological resources in the Eocene Wasatch and Paleocene Fort Union formations underlying the mine permit area.

4.1.9 Recreation

Game harvest on the proposed Rocky Butte Mine could be lost during the life of mine if the area is closed to hunting. However, access to the proposed permit area is currently controlled by private landowners and hunting on the area could be closed at any time. Since postmining reclamation would restore wildlife habitat to premining conditions, all impacts to this land use are considered not significant (Appendix B).

During the years 1994 through 2004, mine pits, with associated stockpiles, are proposed for western portions of the Rocky Butte project area where indeterminant amounts of wildlife observation take place from Wyoming Highway 59. Until reclamation restores wildlife habitat sufficiently to support pronghorn antelope (Appendix B), this recreational resource will be lost. However, impacts are expected to be minor over the life of mine, since no rest areas/observation points currently exist along Highway 59 near the Rocky Butte site.

4.1.10 Air Quality

Adding a sixth mine to the existing group of five mines south of Gillette would increase particulate concentrations in the vicinity of the proposed mine during the operating life of the new mine. The amounts and patterns of increase would vary as the mining proceeded. Insignificant amounts of other regulated atmospheric pollutants, sulfur oxides, sulfuric acid mist, sulfation, hydrogen sulfide, photochemical oxidants, hydrocarbons, nitrogen oxides, fluorides and carbon monoxide would be generated.

Modeling indicates maximum particulate emissions from mining activities would occur in year 7 of the mine plan. Calculated PM_{10} concentrations for that year show the contribution from the proposed Rocky Butte Mine falling below the significance level, 1 $\mu g/m^3$ annual arithmetic mean, at a radius of approximately 10 kilometers. A plot of isoconcentration lines for year 2001, mining year 7, is shown in Figure 4-6. At the Boundary of the Lands That are Necessary to Conduct Mining Operations, hereafter referred to as the Boundary and coincident with the proposed Rocky Butte Mine permit boundary, a maximum contribution of 9.8 $\mu g/m^3$ was calculated for mining activities in year 2001. Calculations for year 2009, mining year 15, indicated concentrations up to 13.0 $\mu g/m^3$ may be generated when mining proceeds close to the Boundary.

When the background PM_{10} and emissions from the five neighboring mines to the south are added to the calculated emissions from Rocky Butte Mine, the maximum concentration along the Boundary, excluding that part of the Boundary contiguous with Caballo Mine, is 28.7 $\mu g/m^3$ in the year 2001. The corresponding value for the year 2019 is 33.7 $\mu g/m^3$. In both cases the PM_{10} concentration would be below the State and Federal standard of 50 $\mu g/m^3$, annual arithmetic mean.

Lands within the Boundary would not be accessible to the general public. Consequently, that area is not subject to State air quality standards. Instead, emissions in that area are governed by MSHA respirable dust regulations. In 2001 Rocky Butte Mine operations would be relatively near Caballo Mine operations, and the major emission sources from the two mines would be roughly

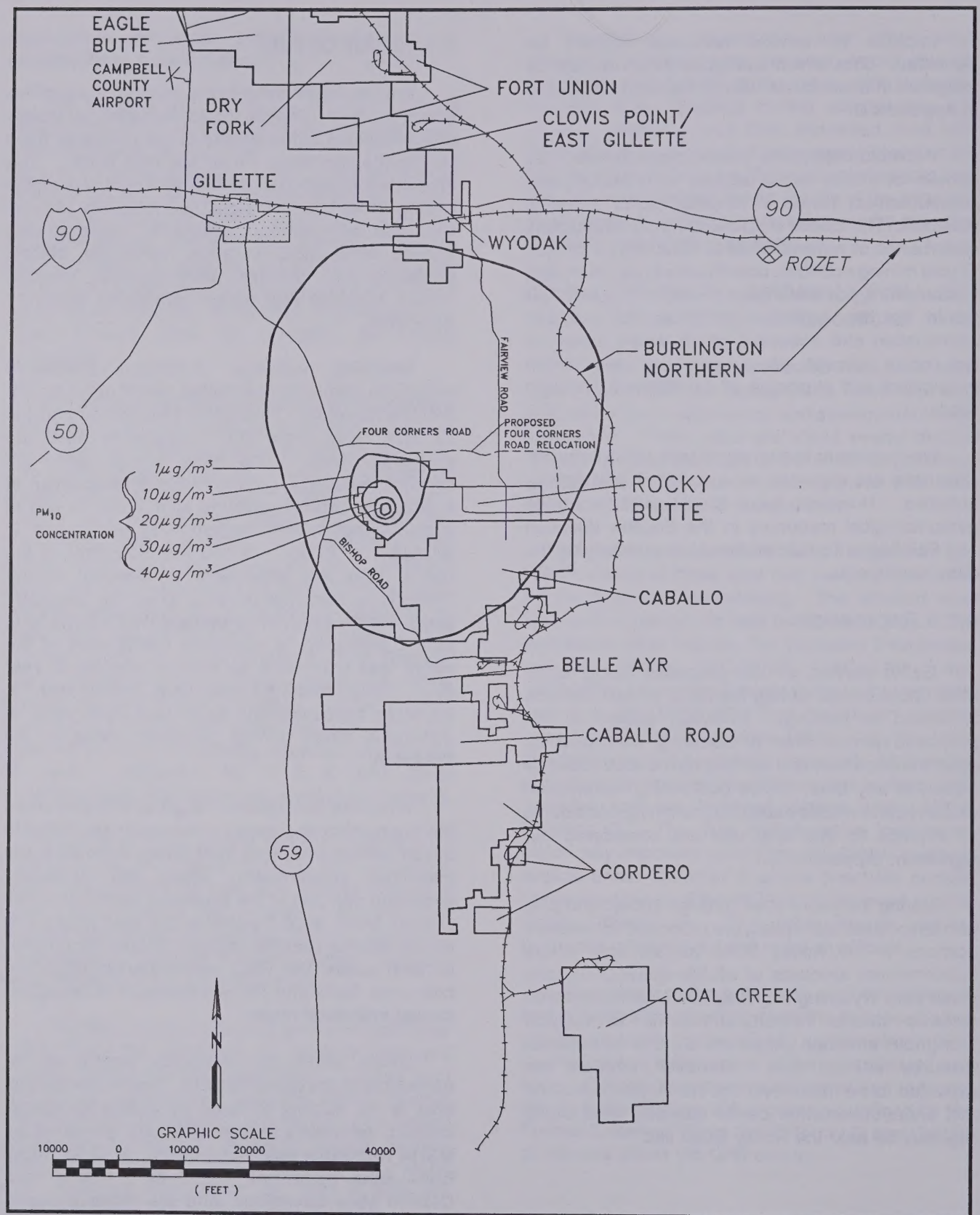


Figure 4–6. Isoconcentration Lines of PM_{10} Emissions Generated from Planned Rocky Butte Mine Operations in Year 2001

aligned with the prevailing winds. The result would be high concentrations of PM_{10} near the mining operations and along the contiguous boundary. When either the proposed Rocky Butte Mine or Caballo Mine is considered alone, neither mine generates enough PM_{10} emissions along the common boundary to cause a violation. Hence, even though the combined maximum, 53.3 $\mu g/m^3$, is greater than the ambient air standard of 50 $\mu g/m^3$, both mines meet the standard.

The State of Wyoming no longer requires short term air quality modeling for a permit application, contending the results are not meaningful. Nevertheless, compliance with the State 24-hour TSP and PM_{10} standards of 150 $\mu g/m^3$ must be demonstrated by the required air quality monitoring program. Non-mining sources, such as agricultural and oil field disturbances can contribute to high 24-hour particulate concentrations. One exceedence of the 24-hour standard is allowed per year.

PM_{10} impacts would be moderate within the Boundary during the mine operations. Exceptions would be areas in close proximity to operations. These areas may be impacted heavily for a number of years while the mining operations are nearby. Outside the Boundary, impacts would be minor. In the long term, impacts from PM_{10} emissions from Rocky Butte Mine operations would be negligible. Impacts on neighboring mines would be moderate for the adjoining Caballo Mine and diminish to insignificant levels within the Belle Ayr Mine. Operations are scheduled to be ending in the neighboring mines from 2009 through 2025 resulting in a gradual decline in PM_{10} concentrations in the region during that period. In general, if the proposed Rocky Butte Mine is constructed, the Eastern Powder River Basin air quality will be decreased in the immediate vicinity of the proposed mine, but will still continue to meet Federal and State standards.

4.1.11 Visual Resources

Alterations in the natural character of the landscape due to mining and associated activities would change the Visual Resource Management classification of the proposed permit area from the existing Class IV to Class V and require rehabilitation to bring it back to the more stringent classification. The primary factors affecting this reduction in visual resource value include the mine pit, service and haul roads, overburden piles, and structures such as powerlines, offices, warehouses, and, especially, facilities to crush, handle, and load coal, including the silos and a new railroad spur. The movement of haul trucks and loaders across the landscape would also change the character of the area from premining status. The visual impact of the coal loadout facilities and large stockpiles could be considered major by nearby residents and travelers on local public roads during the life of mine.

Reclamation and cessation of mining would restore the landscape to a scenic quality similar to the premining quality for the seven factors on which scenic quality is determined: landform; vegetation; water; color; adjacent scenery; scarcity; and cultural modifications. Premining evaluations of these factors resulted in each receiving the lowest possible score in the rating system except for landform and cultural modifications which were awarded intermediate values (Appendix C). Sensitivity levels would not be expected to change, nor would visual distance zones, so the management class would return to the premining Class IV after reclamation.

4.1.12 Noise

Ambient noise levels are believed to be in the 40 to 70 decibel range, depending upon location within the property with respect to Highway 59 and to Caballo Mine operations. The noise level in the immediate vicinity of mining operations is in the range of 85 to 95 decibels. The psychological property of sound called *loudness* is intimately connected with the *intensity* of a sound wave. For a pure tone of given frequency, loudness increases with increasing intensity, but in general the relation between the loudness of a sound and its intensity is not simple. Loudness cannot be measured in physical terms, since it depends on the ear and judgement of the individual observer.

Using intensity as an indicator, it is possible to estimate approximately the distance one would have to be from a sound source of 100 decibels in the mine area to have the sound reduced to ambient levels. This estimate is based on the fact that energy is inversely related to the square of distance and that the logarithm (base 10) of the ratio of two sound intensities is called the difference in intensity level, or *bels*. Ten times this logarithm is called the difference in intensity level in decibels, and this difference is

ordinarily used to compare intensities of two sounds. A sound 10 times as intense as another has an intensity level 10 decibels (db) higher. A sound 100 times (10^2) as intense as another has an intensity 20 db higher. Thus a sound of 100 db has an intensity level one million times (10^6) higher than a sound of 40 db. If the 100-db sound is measured, say, 10 feet from the source, the sound intensity would be reduced to 40 db at a distance of about 10,000 feet (1.9 miles) from the source, assuming no attenuation of the sound. In other words, the sound of 100 db at 10 feet from the source would be reduced to near ambient levels within 10,000 feet from the source. Thus, residents of homes more than 1.9 miles from the active mine area would be unlikely to hear the sounds of the mine above ambient sound levels. There are several occupied homes closer than this distance from the mine. The nearest residence is only 500 feet from one mine activity, the construction of a topsoil stockpile during the first year of pit construction. This residence is also within 500 feet of Highway 59 and so has a higher ambient noise level than is normal for the region. Assuming that there is a sound level of 90 db measured 10 feet from the highway, the sound would be reduced to about 56.6 db at a residence 500 feet from the highway. Since the highway is a part of the existing environment for this particular residence, the 56.6 db may be considered the ambient noise level for this residence. If the construction of the topsoil pile imposes a sound source of 100 db at the same distance from the house as the house is from the highway, the new noise source would be reduced to 66.6 db at the residence. This is 10 db higher, or 10 times as intense, as the calculated ambient level. According to Table 3-7, this would place the noise level at the house at between the "quiet" and "nuisance" level.

Once the stockpile is built, sound levels at this residence would be reduced as the distance from the residence to actual mine activities increases. The presence of the overburden and topsoil stockpiles, once built, could help attenuate noise effects by deflecting and absorbing sound waves from the mine. All the calculations above neglect the effects of attenuation of sound waves.

Based on these calculations and assumptions, it is concluded that the six residences along the northwest and west sides of the Rocky Butte Mine would experience increased noise levels during certain periods of the mining operation. These noise levels would be increased most notably during the earliest and latest years of the operation, when an overburden stockpile and topsoil stockpile are built and then removed. The noise levels at the residences from those operations could reach the lower limit of what is generally considered the nuisance level. This impact could be of moderate significance for the nearest two or three residences for periods of up to a year or more during the life of the mine.

4.1.13 Transportation Facilities

Construction and operation of the proposed Rocky Butte Coal Mine could induce increases in both rail and highway traffic in and around the Gillette area. Minor increases in air travel could be expected from increased business and social travel. In general, minor to moderate increases in congestion, noise and probability of accidents would result.

At full production, the proposed Rocky Butte Mine would add 30 to 31 round trips per week over the Orin-Gillette branch line using the present railroad rolling stock, or about a 10 percent increase in unit train traffic. Because the Rocky Butte Mine spur would be less than 10 miles from the Gillette main line, it is likely most of the resulting increased train traffic would use that line. From the mine location the train traffic radiates to points-of-use. Impacts from railroad operations would be greatest near the proposed mine, but would occur along the entire routes of the coal shipments. The 10 percent increase in train traffic is considered minor.

Highway traffic accidents and delays at grade crossings have been identified as the most severe problems resulting from train traffic. For those communities which straddle the railroad lines, intermittent isolation of parts of the community may result, particularly where grade-separated crossings are not available or are inadequate. Inconvenience and delays in the delivery of essential community services may result (OSM, 1988). If train traffic increases, these problems would be aggravated. In addition, increased noise and decreased air quality along the railroad routes could be expected.

Both the Gillette main line and the Orin-Gillette branch line have sufficient capacity to handle the

projected increase from the proposed Rocky Butte Mine. However, the BNR has begun a test program for coal rail cars with a 35 percent greater capacity than the 100-ton cars now in use. These cars, together with precision loading facilities at most mines, will significantly increase the tonnage hauled per train. Even with increased coal production, the number of unit trains per day is expected to decline over the next few years. With this development the impacts from increased coal haulage on the railroad system from the proposed Rocky Butte Mine would be minor or negligible (Basford, 1991).

Increased traffic volumes would occur within the regional road network beginning in 1993 with the start of mine construction. The greatest impact would result from employee and industrial service travel to the proposed mine site over the section of State Highway 59 south from the intersection with I-90 to the Four Corners Road intersection and along the Four Corners Road to the proposed Rocky Butte Mine entrance. Increases in traffic volumes would generally decrease as the distance from this main artery increased. Secondary increases in traffic volumes would result from increased population in Campbell County and the City of Gillette, both from direct employment at the proposed mine and multiplied secondary economic activity. The increased traffic volumes could result in increased traffic congestion, noise and accidents, decreased air quality and increased maintenance requirements for the road network.

By the seventh year of mining, year 2001, the proposed Rocky Butte Mine could cause from 500 to 600 additional vehicle trips daily along Highway 59 and the Four Corners Road to the mine entrance. LOS analysis by the Wyoming Department of Transportation for this scenario shows 770 vehicles per hour, approximately 43 percent of the highway capacity. The LOS would decline from a low C value to a high D value (Lane, 1991).

Improvements are planned for the Four Corners Road to make the road suitable for carrying the projected traffic load. Planned improvements include widening and paving the road from the intersection with Highway 59 to the mine entrance, a distance of approximately 3.4 miles, and relocating the road out of the mining area, removing the majority of the ninety-degree corners in the process. With these improvements the Four Corners Road is expected to be adequate for the increased traffic flow.

Although isolated problems can be expected to occur, previous development of the road network in Campbell County, induced by rapid growth of the energy industry and implemented by local, State and Federal governments, has equipped the County with a road infrastructure that is generally adequate for estimated future use. Particular attention has been given to traffic circulation within the City of Gillette, over Highway 59 south from the I-90 intersection and outward to the mines to the northeast and northwest of Gillette. In the long term, the impact of increased traffic flow over the County wide road network and over the internal circulation routes of the City of Gillette is expected to be minor. In the short term, impact within the City of Gillette is also expected to be minor, and the impact on the County wide network is expected to be minor with possible moderate areas on Highway 59 and the Four Corners Road.

By the seventh year of mining, year 2001, the proposed Rocky Butte Mine is estimated to cause an increase of 3 to 4 percent in departures and arrivals on commercial flights. A higher percentage increase is expected during the construction phase, possibly as high as 15 to 20 percent, caused by increased construction-related travel. The load capacity factor would be increased for United Express, which may help to stabilize air service at its present level (Kemp and Bell, 1991). Continental Express is currently considering adding another plane to their schedule. If they have not done so by the time construction begins on the proposed Rocky Butte Mine, the increase in airline passengers would probably trigger the addition of a plane to their schedule (Morgan, 1991). Minor increases may be seen in charter and private aircraft use of the Campbell County Airport. Planned improvements to the terminal and commercial passenger loading/unloading areas along with the rest of the existing infrastructure will be adequate to serve projected growth in air travel from the proposed Rocky Butte Mine. The increases could be handled with the present facilities with some increase in congestion in the terminal.

4.1.14 Land Use and Ownership

The principal impact to land use would be the loss of the agricultural productivity of land during

mining and prior to reclamation (Table 4-3). However, because affected agricultural lands would be restored to the approximate acreage existing prior to mining (Appendix B), long-term impacts to agricultural productivity would be negligible. Assuming that 20 percent of the project area is affected in any given year (Table 2-1), construction and life-of-mine impacts to production would be minor or moderate (Table 4-4). To facilitate comparison of potential losses, crop and forage production values are expressed as AUMs. The reduction in crop production would range from 1,275 to 2,732 AUMs, depending on the type of crop lost. Loss of native grazing land productivity would range from 121 to 242 AUMs. Loss of productivity from pastures would range from 13 to 19 AUMs.

Table 4-3 Areas of Projected Disturbance of Land Use Types Within Campbell County, the Rocky Butte Permit Area, and Within the Total Permitted Acreage of All Mines in Campbell County, Wyoming.

Land Use Type	Acreage Occupied by Type, Campbell County[1] (Acres)	Disturbance of Type, Rocky Butte		Portion of Campbell County Disturbed (Percent)	Disturbance of Type, All Mines		Portion of Campbell County Disturbed (Percent)
		(Acres)	(Percent)[2]		(Acres)[3]	(Percent)[2]	
Cropland	158,000	3,643	2.3	0.1	5,457	3.5	0.2
Grazing land	2,747,840	3,020	0.1	0.1	62,477	2.3	2.1
Pastureland	23,020	327	1.4	<0.1	5,877	25.5	0.2
Developed Water	1,800	52	2.9	<0.1	159	8.8	<0.1
Residential	18,110	12	0.1	<0.1	32	0.2	<0.1
Industrial/Commercial	58,070	104	0.2	<0.1	131	0.2	<0.1
Transportation Systems	Included in Industrial/ Commercial Use	130	0.2	<0.1	239	0.4	<0.1
Disturbed	NA[4]	45	NA	<0.1	4,012	NA	0.1
Total	3,043,840[5]	7,333	–	≈0.2	78,384	–	≈2.6

1 Personal communication, October 25, 1991, with Tom Jewett, Deputy State Conservationist, USDA Soil Conservation Service, Casper, Wyoming.
2 Relative to the acreage occupied by the type in Campbell County.
3 Data in this table were compiled from mine permits held by WDEQ-LQD, Cheyenne; and the permit, in preparation, for the Rocky Butte project. Due to variability in permit presentation of land use data, acreages presented herein represent a general summary of data for all mines in Campbell County, Wyoming.
4 Data not available.
5 Total includes acreage for woodlands (36,000 acres in Campbell County, Wyoming).

Because wildlife habitat would be an important postmining land use that would be recreated during reclamation, permanent impacts to wildlife habitat would be negligible (Section 4.1.7). There would be major short-term impacts to habitat during construction and throughout the life of mine due to loss of vegetation, water resources, and topographic features used by wildlife. With respect to available habitat in the region, the short-term loss of this habitat is insignificant.

Owners of occupied and abandoned residences in the affected area have already agreed to relocate. These residences would not be replaced during reclamation.

No oil wells would be disturbed during mine construction and initial production. Comparison of the mine sequence with the planned production schedule for these wells indicates that all the wells will have ceased production by the time they are encountered by the pit. Therefore, life of mine and permanent impacts to oil production would be negligible.

4.1.15 Socioeconomics

The socioeconomic impact area is composed of those political jurisdictions and population centers which will experience the bulk of the social and economic impacts from the proposed Rocky Butte Mine. The impact area includes communities in which project employees will reside, plus jurisdictions that will incur financial effects from mine-related tax revenues or public facility or service expenditures as a result of the project.

The delineation of the area of socioeconomic influence is normally based on a host of considerations, depending upon the local area under study. In this instance, the primary determinants are the size and distance of Gillette, settlement patterns of other similarly located coal projects in Campbell County, certain labor force conditions, and migration patterns.

Table 4-4. Estimated Reduction in Agricultural Productivity Due to Mining in Campbell County and in the Rocky Butte Project Area.

Projected Affected Area	Cropland/(Acres)				Grazing land (Acres)		Pasture land (Acres)
All Mines (including Rocky Butte)	5,457				62,477		5,877
Rocky Butte	3,643				3,020		327
	Wheat[1]	Hay	Barley	Oats	Native Range[2] (Shallow Soils)	(Deep Soils)	Crested Wheatgrass[3]
Potential Loss	Animal Unit Months						
20% of all Mines	4,093	3,656	3,001	1,910	2,499	4,998	235-353
20% of Rocky Butte	2,732	2,441	2,004	1,275	121	242	13-19
Percent loss due to mining at Rocky Butte	67	67	67	67	5	5	6

[1] Assumes yields of 25 bu/ac wheat, barley, and oats, and 1 ton/ac hay. Estimated forage values were 0.15 AUM/bu wheat, 3.35 AUM/ton hay, 0.11 AUM/bu barley, and 0.07 AUM/bu oats (WDEQ-LQD 1981).
[2] Estimated carrying capacities of 0.2 to 0.4 AUM/acre.
[3] Estimated carrying capacities of 0.2 to 0.3 AUM/acre.

The City of Gillette had an estimated 1990 population of about 17,635 persons (Table 3-15), while the Gillette urban area, which includes the city and urbanized but unincorporated areas nearby, had an estimated population of 21,800 in 1990 (Gillette Community Development Department, Planning Division, 1990). To serve these residents, Gillette offers a well developed housing market, commercial and service base, plus commensurate public facilities and services. Gillette is about a 15-minute drive from the proposed Rocky Butte Mine employee entrance. This suggests that the Gillette area would have a strong initial attraction to the mine employees.

Residency data from other coal mines near Gillette provide an indication of what might occur

with the Rocky Butte Mine (Carter Mining Company, AMAX Coal Company, 1991). These data are shown in Table 4-5.

In 1984, a comprehensive survey of the coal companies in Campbell County corroborated the settlement or commuting patterns indicated in Table 4-5 (Stearns Catalytic Corporation, 1984). About 90 percent of the mine employees working at coal mines located in the Gillette vicinity resided in the Gillette area in 1984. The majority of these were located within the City of Gillette. An additional seven percent lived in Campbell County but outside the Gillette area or the Town of Wright. An estimated three percent of the employees at coal mines in this region commuted to work from homes outside Campbell County.

According to Wyoming Department of Employment data, there were about 16,500 persons in the Campbell County labor force in 1990 (Wyoming Department of Employment, Division of Research and Planning, 1990 and 1991a). About 1,060 of these were unemployed, for an unemployment rate of 6.4 percent. Based upon an interview with the local job service office in Gillette, there are an estimated 4,000 persons actively seeking work in Campbell County, primarily in the coal industry (Job Service of Wyoming, 1991).

There is a sizeable labor pool within Gillette and Campbell County skilled in those industries needed by the Rocky Butte Mine. As of the second quarter 1989, there were about 2,800 persons employed at Campbell County coal mines. A heavy construction workforce of about 320 persons was also evident, suggesting that these construction workers might not be readily available when Rocky Butte begins development. The workforce characteristics suggest that sufficient numbers of persons are both available and skilled within Campbell County to fill the coal mining jobs at the Rocky Butte Mine during the operational phase.

Table 4-5. Settlement Patterns of Nearby Projects

Place of Residence	The Carter Mining Company Rawhide and Caballo Mines	Amax Coal Co. Belle Ayr Mine
Gillette Area	78%	84%
Other Campbell County	16%	3%
Subtotal Campbell County	94%	87%
Outside Campbell County	6%	13%
Total	**100%**	**100%**

Based upon the Campbell County labor force characteristics and historical experience of other mines in Campbell County, almost all the operational workforce at the Rocky Butte Mine will be hired from among existing Campbell County residents. An estimated 90 percent of the operational or permanent workforce will come from persons living in Campbell County. Ten percent of this workforce will be in-migrants.

For the construction workforce, it is likely that the bulk will be hired from outside Campbell County. There could be additional pressure on the construction workforce from a planned expansion of the Black Hills Power & Light power plant at the same time. Outside contractors will also likely be used. This suggests that 75 percent of the mine construction force will be hired from outside Campbell County. These individuals will temporarily reside in the Gillette area for the project's development phase and probably leave thereafter unless other construction work can be found.

On the basis of the above data, the majority of mine-site employees, including operational and construction workers, are expected to reside in the

Gillette area (Table 4-6). Therefore the area of socioeconomic influence is defined as the Gillette area and Campbell County, which would incur financial effects from the project.

The socioeconomic impact analysis is based upon the schedule depicted in Table 2-1. Mine impacts are projected and evaluated through the year 2000 when mine related impacts, tax revenues and secondary effects would have the sustained maximum effect. The level of impact would continue through the life of the mine at approximately the same level. Proportionate cumulative impacts would diminish as impacts are constant and baseline Campbell County conditions expand over time.

Employment effects attributable to the Rocky Butte Coal Mine would consist of direct employment during the construction and operational phases of the mine as well as induced, or secondary, employment. This indirect type of employment stems from mine employee expenditures in the local area along with the mining company's direct purchases of goods and services in Campbell County. As these dollars circulate throughout the local economy, they generate additional jobs.

Table 4-6. Projected Rocky Butte Commuting Patterns

Place of Residence	Portion of Direct Project Employment
Gillette Area	90%
Other Campbell County	5%
Subtotal Campbell County	95%
Outside Campbell County	5%
Total	100%

Direct employment at the mine includes temporary construction workers and the more permanent operational employees. The distinction is important from a socioeconomic standpoint because operational employees have larger, longer term socioeconomic impacts as compared with coal mine construction workers.

Construction employment is projected to be an annual average of 125 persons in 1993 and 130 persons in 1994. A peak construction employment of 200 persons is anticipated during 1994. The mix of heavy construction and special trades job opportunities will be typical for surface coal mine development projects in this region.

Table 2-3 depicts the operational employment schedule for the Rocky Butte Mine by year. Operational employment at the mine would begin during the development phase, primarily to accomplish overburden removal and to bring certain project facilities into operation. Employment buildup would occur until about 1997 when more than 400 total mine employees are anticipated. Between the year 2001 and project completion in the year 2034, total employment would fluctuate modestly but average about 420 persons.

Based upon the commuting patterns projected earlier, 90 percent of the operational or production employees will reside in the Gillette area while 5 percent will commute from homes elsewhere in Campbell County and an additional 5 percent will commute from outside Campbell County. Construction worker settlement patterns should be similar to these.

Based upon previous studies of the Campbell County economy, the basic employment to local service employment ratio, or employment multiplier,

is assumed to equal 1.0 (Stearns Catalytic Corporation, 1984). That is, for every basic job such as those from the Rocky Butte Mine, one additional local service job opportunity would be generated. Hence, induced or indirect employment stemming from the Rocky Butte Mine would amount to over 400 persons at sustained operating capacity.

Total employment impacts from the Rocky Butte Mine include direct and indirect employment. During 1993, for instance, total employment effects equal the sum of 125 construction workers, 161 mine employees, and 161 local service employees. Total employment attributable to the mine in 1993 is therefore 447 employees. Due to the modest construction work force of the mine, its temporary nature, and the size of the Campbell County economy, no local service response is anticipated from mine construction employment.

In 1995, total employment effects would equal 688 persons. Employment effects would drop in the next year as the construction work force diminishes and then gradually build up to a sustained maximum of approximately 820 total job opportunities.

Economic impacts from the Rocky Butte Mine would consist of increases in personal income levels and resulting gains in commercial activity. Both direct and indirect effects would follow from the establishment of this mine.

The direct effects of the mine stem in part from the wages and salaries paid to construction and production employees. It is estimated that the average wage or salary for construction and mine employees would be about $16,700 per year and $34,600 per year, respectively, excluding all benefits (Wyoming Department of Employment, Research and Planning Division, 1989). Applying these earnings assumptions to projected employment levels, the total payroll from the Rocky Butte Mine can be projected by year as presented in Table 4-7. At sustained maximum operation, the Rocky Butte Mine would add a payroll of about $14 million per year to the Campbell County economy directly from its employees.

In addition, the Rocky Butte Coal Mine would make direct expenditures for other goods and services throughout the life of the mine. During the construction phase, an estimated $150.7 million (1991 constant dollars) would be expended for various mine facilities and mining equipment, including an estimated $8 million for engineering services. During the course of the mine operation, additional capital expenditures would be made for equipment and facilities totaling about $4.4 million per year or $181.5 million in total for the life of mine. Assuming sales and use tax permits are required, the mine would generate substantial sales and use tax revenues for the state as well as local government entities. Additional but more modest expenditures will be made annually for mine supplies and contract services; except for the latter, almost all of the other expenditures will be made outside Campbell County.

Table 4-7. Estimated Wages and Salaries for the Rocky Butte Mine, Millions of 1991 Dollars

Year	Construction Workers	Operational Employees	Total Direct Wages and Salaries
1993	$2.1	$5.6	$7.7
1994	2.2	9.6	11.8
1995	--	11.1	11.1
1995	--	12.8	12.8
1997	--	14.9	14.9
1998	--	13.9	13.9
1999	--	15.4	15.4
2000	--	16.7	16.7
Average - 2001 to 2034	--	14.1	14.1
Total - Life of Mine	$4.3	$579.6	$583.9

Source: Based upon NWR estimates and Wyoming Department of Employment data for 1989, escalated to 1991 dollars.

Induced employment generated as a result of the Rocky Butte Mine will also add to the payrolls of Campbell County. Assuming an after-benefits annual wage of about $9,000 per year, total indirect wages and salaries will range from $1.5 million to $4.5 million per year with a life-of-mine total of about $155 million (Wyoming Department of Employment, Research and Planning Division, 1989). The average annual earnings from indirect employees attributable to the Rocky Butte Mine will be approximately $3.6 million annually. The total payroll resulting from the mine (about $18 million per year) would have a moderate effect on total wages in the county.

Table 4-8 provides projected earnings, excluding benefits directly and indirectly attributable to the Rocky Butte Mine. These projections are believed to be understated in part because other purchases for goods and services at the mine are not accounted for.

Expenditures for mine-related wages and salaries and other goods would stimulate the local economy in a positive way. Most household expenditures are devoted to retail purchases and various services. Projected increases to Campbell County retail and service trade attributable to the Rocky Butte Mine are set forth in Table 4-9. At sustained maximum operations, the Rocky Butte Mine would account for about $4.8 million in Campbell County retail trade and $7.6 million in service trade for a total contribution to the economy of about $12.4 million, a moderate impact that would be felt for the life of the mine. For the life of mine, Rocky Butte would contribute nearly $512 million to the commercial base of Campbell County.

Mine related employment in many instances means that new households and additional population would be brought into the area. In this instance, almost all of the operational employees at Rocky Butte would likely be hired from among existing residents in the Gillette area and in Campbell County. The indirect employees attributable to the mine are also likely to be drawn from among the ranks of the unemployed and those currently outside the labor force but living in the County. Even so, at least a portion of the job openings left by those going to work at the Rocky Butte Mine would be replaced by others, which might include persons in-migrating to Campbell County. Typically, there is a general switching and upgrading of jobs which occurs, resulting in lower unemployment, more workers per household, and an upgrading of jobs among existing residents. A certain amount of replacement of job openings with persons in-migrating from outside Campbell County would occur. To maintain a worst-case perspective for this EIS, it is assumed that all new jobs would ultimately be replaced by persons in-migrating to the County. In reality, this is only likely to occur to a partial extent.

Table 4-8. Total Earnings Attributable to the Rocky Butte Mine, Excluding Benefits, Millions of 1991 Dollars

Year	Direct Employees	Indirect Employees	Total Earnings
1993	$7.7	$11.3	$9.2
1994	11.8	2.8	14.3
1995	11.1	2.9	14.0
1996	12.8	3.3	16.1
1997	14.9	3.9	18.8
1998	13.9	3.6	17.5
1999	15.4	4.0	19.4
2000	16.7	4.4	21.1
Average - 2001 to 2034	14.1	3.8	17.8
Total - Life of Mine	$583.9	$155.0	$783.9

Source: NWR, Wyoming Department of Employment and BBC estimate, October 1991.

BLM Library
Denver Federal Center
Bldg. 85, OC-521
P.O. Box 25047
Denver, CO 80225

Table 4-9. Total Campbell County Retail and Service Trade Attributable to the Rocky Butte Mine, Millions of 1991 Dollars

Year	Retail	Service	Total Trade
1993	$2,440	$3,874	$6,314
1994	3,841	6,096	9,937
1995	3,772	5,987	9,759
1996	4,321	6,858	11,179
1997	5,045	8,007	13,052
1998	4,863	7,432	12,295
1999	5,196	8,248	13,444
2000	5,628	8,934	14,562
Average - 2001 to 2034	4,786	7,605	12,391
Total - Life of Mine	$197,819	$313,996	$511,815

Source: BBC estimates based upon U.S. Department of Commerce data, 1991.

Incremental households and populations attributable to the Rocky Butte Mine are set forth in Table 4-10. At sustained maximum operations, approximately 530 households and almost 1,600 persons would be directly or indirectly attributable to the Rocky Butte Mine. A peak of about 1,850 persons would be attributable to the mine in the year 2000. A large proportion of the total households and population attributable to the mine would be located within Campbell County, and of these, the bulk would be situated within the City of Gillette. Based upon the commuting pattern established earlier 95 percent of the households and population would be located within Campbell County. An estimated 90 percent of the total households and population would likely be located in the Gillette area. It is assumed that the City of Gillette will account for 90 percent of the Gillette area in the future. Based upon these assumptions and the previous impact projections, households and population related to the mine are projected for Campbell County and the City of Gillette. At sustained maximum, the City of Gillette will have about 1,300 mine-related residents compared with 1,500 mine related residents in Campbell County. This is considered a moderate impact on population.

Table 4-10. Projected Households and Population Directly and Indirectly Attributable to the Rocky Butte Mine

Year	Households			Population			City of Gillette		Campbell County	
	Direct	Indirect	Total	Direct	Indirect	Total	Households	Population	Households	Population
1993*	190	101	291	495	285	770	236	640	277	751
1994*	272	174	446	742	511	1,263	362	1,015	425	1,190
1995	215	202	417	657	590	1,247	338	1,010	396	1,185
1996	247	231	478	751	675	1,426	387	1,248	492	1,464
1997	288	270	558	876	787	1,663	452	1,347	530	1,580
1998	267	251	518	811	729	1,540	420	1,248	492	1,464
1999	297	278	575	899	808	1,707	466	1,383	546	1,621
2000	321	301	622	972	874	1,846	504	1,495	591	1,753
Average - 2001 to 2034	270	255	525	820	729	1,561	427	1,265	501	1,484

*Includes construction-related households at 1.5 workers per household, 2.0 persons per household and no local service response.
Source: BBC Estimates, 1991.

Incremental impacts on the local housing market would vary by project phase, by location, and by housing unit type. Impacts will generally be positive on the housing market which appears to be capable of responding to this stimulus.

Operational employees and local service workers in-migrating to Campbell County and the Gillette area would impact the single family and apartment markets to a large extent. If almost all of these workers come from among the existing residents in Campbell County and are not replaced by in-migrants, there will be little or no impact on the housing market. To the extent that replacement occurs from in-migrants, the impacts would grow slowly over time and are sufficiently modest that the private housing industry should be able to accommodate and respond to such demands.

During the construction phase of the project there would be an additional demand for about 80 temporary dwelling units in Campbell County, mostly in the Gillette area. These could include RV spaces, mobile homes, or apartments. There are a substantial number of empty mobile home spaces and RV spaces in the Gillette area, but demand in the early to mid 1990's for these types of units could be substantial, also.

The incremental impacts of the Rocky Butte project on public facilities and services would be felt by Campbell County, Campbell County School District #1 and the City of Gillette. The levels of these impacts are somewhat problematic because it is uncertain whether any in-migration would occur during the project operational phase. If none occurs, there should be little or no incremental impacts on public facilities or services as a result of the Rocky Butte Mine. Under worst-case circumstances, the incorporated jurisdictions within Campbell County would be required to provide services for the population and households directly and indirectly related to the mine.

If they occur, impacts to Campbell County would focus on protection services. Campbell County Sheriff's Department and Fire Department could have incremental demands associated with the mine. These would be particularly important during the construction phase when more than average per capita burdens are likely to occur. However, total construction worker households are likely to amount to fewer than 90 households in 1993 and 1994. Emergency health services could also be important during this time period, but the proximity of the mine and accessibility to Gillette would reduce that burden. In sum, impacts on Campbell County's public facilities and services, if any, would be minor.

Impacts on Campbell County School District #1 would be largely related to new students directly and indirectly attributable to the mine. During the 1993 and 1994 time frame, an additional 340 students might occur with a peak of about 480 by the year 2000. These students would be at different grade levels and schools mostly in the Gillette urban area. Classroom space and operating expenditures as well as other costs would be required to accommodate these students. Property tax revenues should be adequate to accommodate these burdens, should they occur.

The additional population in Gillette, should it occur, could represent a burden on the water, wastewater and utility system, protection services and recreational facilities. On the whole, the various Gillette utilities should be able to accommodate the incremental growth associated with the Rocky Butte Mine. The Gillette Police Department could be burdened during the construction phase of the project when disproportionate per capita demand might occur. The Police Department is understaffed, and these impacts deserve attention.

The Rocky Butte Mine, through the payment of various taxes, royalties and fees, would generate additional monies for federal, state and local governments. In addition, employees directly and indirectly attributable to the mine would also pay taxes to various levels of government. Depending on the level of in-migration, modest cost increases might occur but should be more than offset by incremental revenues.

Federal revenues for royalties, black lung taxes and AML (abandoned mine land) taxes would average $16.9 million per year and total $656.6 million for the life of mine; these do not include federal income taxes from either the company or mine related employees. This is a moderate impact on federal revenues from the EPRB.

The State of Wyoming would receive revenues directly and indirectly attributable to the Rocky Butte

Mine over its mine life. From severance taxes, gross proceeds taxes, and the state's share of royalties and sales and use taxes, the mine would generate a combined annual average revenue of $11.5 million and cumulative life-of-mine revenues of about $418.1 million. These projections exclude other state fees and revenue sources. The State's share of federal royalties is distributed to numerous accounts. The State Foundation Program receives nearly 50 percent of the State's share. The Rocky Butte Mine would generate severance tax revenues for the state amounting to $137 million over the life of the mine, expressed in constant 1991 dollars. Severance tax revenues are distributed to seven State funds. The General, Highway, Permanent Mineral Trust, and Water Development Funds are the largest beneficiaries. The revenues to the state would have a moderate impact on total state revenues lasting over the entire mine life.

Each incorporated jurisdiction within Campbell County would receive revenues as a result of the Rocky Butte Mine. Major mine-related revenues are projected in Table 4-11. These jurisdictions would be required to provide facilities and services for mine-related population which might or might not be in Campbell County already. Even if substantial in-migration results, these revenues should more than offset additional expenditures incurred by local governments.

Campbell County would receive, at a minimum, property taxes on mine production, mine facilities, and equipment. These would diminish over time and are subject to changes in mill levies. Sales and use

Table 4-11. Selected Local Government Revenues Generated Directly from the Rocky Butte Mine

	Millions of 1991 Dollars	
	Average Annual	Total Life of Mine
Campbell County		
Property Taxes (mine and coal production only)	$0.9	$33.4
Sales/Use Taxes		
Mine facilities and equipment	$0.1	$2.1
Mine related employees	0.0*	1.4
Subtotal - County	$1.0	$36.9
Campbell County School Districts		
Property Taxes (mine and coal production only, prior to State Foundation Program or recapture)	$2.8	$103.5
City of Gillette		
Sales/Use Taxes		
Mine facilities and equipment	$0.1	$3.5
Mine related employees	0.1	2.5
Subtotal - Gillette	$0.2	$6.0
Wright		
Sales/Use Taxes		
Mine facilities and equipment	$0.0*	$0.3
Mine related employees	0.0*	0.2
Subtotal - Wright	0.0*	$0.5

* Less than $50,000

Source: BBC estimates based on information from NWR and local governments.

tax revenues would also accrue to the County, primarily in the early project phases. Total average annual revenues would approximate $1.0 million, representing a moderate increase in total local revenues.

The Campbell County School District would receive property taxes in a manner similar to the County but at much higher levels because of its mill levy. However, because of the Wyoming State Foundation Program only a portion of the net benefits would be realized.

The City of Gillette would have the largest responsibility for serving mine-related residents but would receive fees and tax revenue for many of these services. Sales and use taxes are a major revenue source for the city; the Rocky Butte Mine would result in additional revenues of $200,000 per year on average.

A concern has been expressed by certain residents related to the various impacts of the mine on homes or other residential properties near the mine site. These impacts could stem from mine dust, noise, traffic congestion or visual impacts. Each of these is addressed in other sections of this EIS. However, in the aggregate, such impacts reflect upon quality of life and even property values. There are a small number of dwelling units in the vicinity of the mine. Visual impacts should be reduced for subdivisions and dwellings to the north because of the existing and planned changes to the terrain.

There are a number of coal mines in proximity to residential developments in the Gillette area. It is unclear whether or not these mines have had negative impacts on the quality of life or property values for these homeowners. Given the uncertain evidence of such impacts and the small number of dwellings affected, these impacts are assumed to be minor. Those homeowners requiring relocation because of the mine plan will be compensated accordingly, based upon fair market value.

4.2 Analysis of the No Action Alternative

4.2.1 Geology and Mineral Resources

The primary alternative to the Proposed Action is the No Action Alternative, in which case the Rocky Butte Mine would not open as planned. The geology and overburden within the mine area would not be disrupted, and the coal would remain available for mining at some time in the future.

4.2.2 Topography

Under the No Action Alternative topography on the proposed permit area would not be altered from its present condition.

4.2.3 Soils

If the Rocky Butte tract is not mined, use of the permit area would likely continue as in the past. Soil horizons would not be mixed, erosion would continue at present rates, and soils would continue to support livestock grazing and wildlife.

4.2.4 Vegetation

Under the No Action Alternative, there would be no impacts to vegetation.

4.2.5 Water Resources

Under the No Action Alternative, impacts to area water resources would be limited to those projected to occur due to existing mining operations. Tisdale Creek and North Tisdale Creek will be mined and reclaimed in the Caballo Mine permit area. Groundwater drawdowns will still occur, but without the incremental increases from the Rocky Butte Mine.

Without the Rocky Butte Mine, there would presumably be no potential for blasting impacts to local water supply wells. In a public scoping meeting, some area residents stated that they can feel ground vibrations from blasting conducted at the Caballo Mine. There was no indication, however, that the vibrations have caused any damage. Without the Rocky Butte Mine the subject area will still be subject to some ground vibration from

blasting as the Caballo Mine continues its mining progression in a general westwardly and northwestwardly direction.

4.2.6 Alluvial Valley Floors

Under the No Action Alternative streamflows in Tisdale Creek, North Tisdale Creek, Gold Mine Draw and Dry Donkey Creek would not be disturbed by mining at Rocky Butte. The quality and quantity of the streamflows would remain unchanged from existing conditions.

4.2.7 Fish and Wildlife

Impacts to wildlife under the No Action Alternative will be limited to those that will occur due to ongoing mining operations in the region.

4.2.8 Historical, Archaeological, and Paleontological Resources

The No Action Alternative would result in no effect on cultural resources. The No Action Alternative will negate the positive impacts to paleontological resources of possible exposure of specimens and data recovery resulting from excavation of fossiliferous geologic formations.

4.2.9 Recreation

Under the No Action Alternative, recreational opportunities for hunting and wildlife observation would remain unchanged.

4.2.10 Air Quality

Air quality effects of mining would be limited to those that will result from existing mines.

4.2.11 Visual Resources

Should the Rocky Butte Mine not be built, visual resources would likely remain similar to existing conditions, and the area would remain a Class IV area.

4.2.12 Noise

Under the No Action Alternative incremental noise sources from the Rocky Butte Mine would not be imposed.

4.2.13 Transportation Facilities

Should the proposed Rocky Butte Mine not be constructed, railroad traffic, road network traffic and air traffic would not increase above those levels produced by current economic and social activities in the region, and no associated impacts would occur.

4.2.14 Land Use and Ownership

Under the No Action Alternative, there would be no changes in land use above and beyond those that would occur due to current management practices.

4.2.15 Socioeconomics

The No Action Alternative would result in negative socioeconomic impacts since the job opportunities, stimulus to the local economy and net public sector financial benefits stemming from the Rocky Butte Mine would not occur. This assumes that if West Rocky Butte is not leased and the Rocky Butte lease is not mined, the coal is never recovered. Federal revenues of $656.6 million, State revenues of $418.1 million and local revenues of $146.9 million would not be realized.

Certain minor negative impacts would also not occur if the mine were not developed. The additional pressure on the temporary housing market during the construction would not occur. The eventual loss of jobs and revenue sources when the mine closes also would not occur.

5.0 MITIGATION

Surface mining and reclamation are reaching a mature stage in Wyoming and the EPRB. Advances in reclamation technology have taken place in part due to a progressively advancing regulatory framework that began with Wyoming's 1969 Open Cut Land Reclamation Law, was further developed under Wyoming's 1973 Environmental Quality Act, and has culminated in today's Wyoming State Program approved under the 1977 Federal Surface Mine Control and Reclamation Act.

Many measures to reduce or eliminate (mitigate) adverse effects of surface mining have now become standard industry practice. Examples are listed in Appendix D.

Work done in the preparation of this EIS has not identified any environmental features at the Rocky Butte property which would make it unusually difficult to mine or reclaim using conventional technologies. However, considerable work remains to be done before a permit to mine can be issued, even if the Proposed Action is taken and the WRB lease tract is sold. During the permit process, any remaining environmental issues would be identified by Wyoming DEQ and OSM, and the mine PAP would be revised to address these issues. Minor issues left unresolved at that stage may result in permit conditions or stipulations. The permittee's response to these conditions can be considered mitigation, but specific measures cannot be predicted at this time.

6.0 CUMULATIVE IMPACTS

Cumulative environmental impacts are those which result from the incremental impacts of an action added to other past, present, and reasonably foreseeable future actions, regardless of who is responsible for such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7). This EIS addresses cumulative impacts as the incremental impacts that would result from mining and mining-related activities at the proposed Rocky Butte Mine when added to the impacts that would result from mining and mining related activities at other regional coal mines.

Some cumulative impacts have necessarily been addressed in Chapter 4 of this EIS as dictated by the types of impacts being examined. For example, air quality impacts must, from both a practical and regulatory standpoint, be evaluated with full consideration of the adjacent operating mines. Hydrologic impacts have also been analyzed in light of the fact that the Rocky Butte Mine is adjacent to a cluster of existing mines and is in an area now undergoing water-level drawdowns in the shallow aquifer system.

The Rocky Butte tract has been considered in two of the four regional coal leasing EIS's in the Powder River Basin. This section examines the predicted coal and coal-related developments and their related impacts as presented in these four regional EIS's in light of the coal development and related impacts that have already occurred. Specific emphasis is placed on developments in Campbell County, Wyoming.

There are currently 7.797 billion tons of federal coal underlying 102,426 acres under lease in the Wyoming portion of the Powder River Basin. The six LBA's received to date propose to add approximately 1.035 billion tons of federal coal underlying 8,428 acres. This amount of coal would be offered over the next 3 to 4 years, and even though offered, some may not be leased due to many factors. The amount of coal in these LBA areas represents an increase of 13 percent of leased federal coal and an increase in acreage of 8.2 percent. Since the 1990 coal production for the Wyoming portion of the Powder River Basin was 162.6 million tons, the coal underlying the proposed leases represents approximately 6.4 years of reserves for the basin as a whole. The 1990 coal production for Campbell County was 154.7 million tons. The coal which would be added by the six pending LBA's is therefore equivalent to about 6.7 years of production at the 1990 Campbell County production rate.

6.1 Actual and Predicted Coal Activity in the Eastern Powder River Region

This section presents a review of the cumulative analysis which is contained in each of four regional EIS's prepared during the 1970s and early 1980s. The four analyses are:

- Final Environmental Impact Statement, Eastern Powder River Coal Basin of Wyoming, BLM, October 1974.
- Final Environmental Impact Statement, Eastern Powder River Coal, BLM, March 1979.
- Final Environmental Impact Statement, Powder River Coal Region, BLM, December 1981.
- Draft Environmental Impact Statement, Round II Coal Lease Sale, Powder River Region, BLM, January 1984.

This review provides an assessment and analysis of cumulative environmental impacts based on the current coal production outlook and presently anticipated levels of regional development activity. The analysis reviews cumulative impacts identified in the above-referenced EIS's as compared to actual development activity which occurred. This cumulative analysis also incorporates data, monitoring results and research done since the EIS's were done, or in response to impacts identified in these EIS's which will provide further assessment of cumulative impacts resulting if the lease-by-applications currently pending before BLM are approved.

The coal region in which the current lease-by-applications are located can be defined as the Eastern Powder River Coal Region and is generally considered to include Campbell and Converse

Counties in Wyoming. In the 1970s and early 1980s there was a great deal of interest and activity in mining existing leases and acquiring new federal coal leases. As a result, the four referenced regional EIS's were prepared, and each identified and discussed the regional, cumulative impacts resulting from coal development, coal-related development, and other regional activities based on reasonably foreseeable development scenarios at the time. All the mines currently operating, including those requesting LBA's, in the Eastern Powder River region were specifically addressed in one or more of the referenced EIS's, as shown in Table 6-1. Each regional EIS contained predictions of mining activity into the future, including the number of mines, production levels, and acreage requirements.

Table 6-1. Mine Sites Addressed in Prior Regional Coal Development EIS's

Mine	Operator	1974 EIS	1978 EIS	1981 EIS	1984 DEIS
Antelope	Antelope Coal Co.	x		x	x
Belle Ayr	Amax Coal Co.	x	x	x	x
*Black Thunder	Thunder Basin Coal Co.	x	x	x	x
Buckskin	Triton Coal Co.		x	x	x
Caballo	Carter Mining Co.		x	x	x
Caballo Rojo	Mobil Coal Producing		x	x	x
Clovis Point/East Gillette	Kerr-McGee Coal Corp.		x	x	x
Coal Creek	Thunder Basin Coal Co.		x	x	x
Cordero	Cordero Mining Co.	x	x	x	x
Dave Johnston	Pacificorp	x	x	x	x
Dry Fork	Dry Fork Coal Co.			x	x
*Eagle Butte	Amax Coal Co.	x	x	x	x
Fort Union	Fort Union Ltd.			x	x
*Jacobs Ranch	Kerr-McGee Coal Corp.	x	x	x	x
Keeline	Neil Butte Co.			x	x
*North Antelope	Powder River Coal Co.	x	x	x	x
North Rochelle	Shell Mining Co.			x	x
Rawhide	Carter Mining Co.	x	x	x	x
*Rochelle	Powder River Coal Co.	x	x	x	x
*Rocky Butte	Northwestern Resources Co.			x	x
Wyodak	Wyodak Resources Dev.	x	x	x	x
TOTALS:		11	15	20	20

* LBA application on file

Coal-related developments, such as power plants, coal gasification, and other coal conversion industries were predicted. Other regional activities such as oil and gas, uranium, and any other known major development activities were also predicted. An analysis was developed to identify and evaluate impacts of all of these activities taken together.

Table 6-2 shows what activity has actually taken place in the region, and also shows the cumulative total of the activity that has actually taken place added to the activity predicted based on the LBA's which are currently pending before BLM. The table also illustrates the predictions of coal, coal-related and other regional development activity upon which the cumulative impact analysis for each of these regional EIS's is based.

Table 6-2 shows that the actual level of development which occurred by 1990 is within the range of predictions made in the referenced EIS's. The 1979 EIS was the closest prediction, which is explained by the fact that the 1981 and 1984 EIS's were assuming high levels of new leasing and new development of pending preference right lease applications. Market conditions have not favored the development of new mines.

Table 6-2. Cumulative Regional Activity, Eastern Powder River Coal Region (Campbell and Converse Counties, Wyoming)

	1990 Actual Activity	1990 Actual Activity + LBA's	1974 Predictions Of 1990 Activity	1979 Predictions Of 1990 Activity	1981 Predictions Of 1990 Activity	1984 Predictions Of 1990 Activity
Number of Producing Mines	18	19	14	15	40[1]	37[1,2]
Number of Power Plants	3	3	6	2	3	3
Number of Gasification Plants	0	0	2	1	0	0
Leased Federal Coal (Millions of Tons)	7,796.5	8,831.5	Not Available	Not Available	Not Available	Not Available
Acres of Leased Federal Coal	102,426	110,854	93,075	Not Available	Not Available	Not Available
Coal Production (Millions of Tons Per Year)	162.6	178.6	150	174.3	332.9[1]	292.1[1,2]

1. Calculated from Wyoming and Montana totals in EIS. This EIS covered the entire Powder River Basin.
2. Baseline or "No Action" alternative used from this EIS as the 1984 was not finalized and, therefore, the actions proposed were never taken.

Sources of 1990 data: 1990 Annual Mine Reports for Eastern Powder River Region mines and BLM Casper District records.

Many of the impacts of the development activities are related to the amounts of surface disturbance, new employment, and resources consumed by the activity. Table 6-3 shows the 1990 predictions for each regional EIS as to acres disturbed and reclaimed, employment, and population. This table also illustrates surface disturbance and reclamation, employment and population that actually had occurred or existed in 1990.

Cumulative surface disturbance to date is about 32,000 acres. This is within the range of predictions of the referenced EIS's and, with all the pending LBA's added, represents less than one tenth of one percent of the region. The acreage disturbed has been specifically analyzed in the referenced EIS's, and no unique soils or vegetation types were identified as being impacted. The disturbed acreage is being reclaimed, with about one third of the already-disturbed area having been contoured, topsoiled and reseeded.

Table 6-3. Cumulative Surface Disturbance, Employment and Population -- Actual and Predictions -- Without the Lease-By-Applications, Eastern Powder River Coal Region (Campbell and Converse Counties)

	Actual 1990 Levels	1974 Predictions of 1990 Levels	1979 Predictions of 1990 Levels	1981 Predictions of 1990 Levels	1984 Predictions of 1990 Levels
Acres Disturbed	31,744	13,887	22,794	43,550[1]	40,900[1,2]
Acres Reclaimed	9,199	4,132	12,666	24,200[1]	22,800[1,2]
Coal Employment	2,862	5,200	3,899	11,900	11,500[2]
Total Population	40,498	65,600	59,400	69,000	62,300[2]

1. Calculated form Montana and Wyoming totals in EIS. This EIS covered the entire Powder River Basin.
2. Baseline or "No Action" alternative used from the EIS as the 1984 EIS was not finalized, and therefore the actions proposed were never taken.

Sources of 1990 data: 1990 Annual Mine Reports for Eastern Powder Basin Mines, BLM Casper District Records, 1990. Census Results for Wyoming Counties/Municipalities, "Annual Report of Mines of Wyoming" through December 31, 1990.

Cumulative transportation impacts are related to coal production and employment levels and are therefore well within the level of impacts identified in the referenced EIS's.

Table 6-4 presents a comparison between actual 1990 coal production in Campbell County and the predicted 1990 level of production as evaluated in the 1981 regional EIS. That EIS contained predicted coal production levels by mine (or by lease tract) for the seventeen Campbell County coal mines that were in operation or permitted in 1981, the nine additional properties under lease in 1981, and for eight additional Campbell County tracts proposed for bidding in the 1982 Eastern Powder River Basin lease sale. As the table shows, actual production in Campbell County in 1990 was 154.7 million tons, or about 47 percent of the 1990 level as predicted in the 1981 regional EIS.

6.2 Actual and Predicted Coal Activity in Campbell County

Of the new lease tracts proposed for sale in 1982, four (Little Rawhide, Duck Nest Creek, Fortin Draw and Spring Draw) became maintenance tracts for existing mines. No mine has been permitted for the other four leases, one of which is the Rocky Butte lease.

Table 6-5 provides a comparison between the hypothetical Rocky Butte tract mine developed for the 1981 regional EIS and the Rocky Butte Mine as currently proposed by NWR, including the WRB tract. The mine and reclamation plan for the Rocky Butte tract as described in the 1981 regional EIS was more fully described in the Rocky Butte Tract Profile (BLM, 1981). Table 6-5 indicates that the current proposal has a larger coal reserve, reflecting both the addition of the WRB tract and more complete geologic information based on additional drilling done since 1981. The recovery factor is also larger in the current proposal, reflecting development of a more detailed mine plan and the fact that the 90-percent recovery assumed in the 1981 tract profile is believed to be conservatively small by current standards.

The coal production rates for the two scenarios are similar (15.1 million tpy in the 1981 tract profile vs. 16 million tpy in the NWR proposal). Disturbed area has increased from 5,000 acres predicted in the 1981 tract profile to 7,333 acres in the NWR mine plan. This increase is probably reflective of the more complete mine plan available from the NWR proposal.

Table 6-4. Comparison Between 1990 Campbell County Coal Production by Mine As Predicted in 1981 Regional EIS and As Actually Occurred

Mine Name	Operator	1990 Production Predicted in 1981 Regional EIS[2] (mmtpy)	Actual 1990 Production[3] (mmtpy)
EXISTING MINES (AS OF 1981)			
Black Thunder	Thunder Basin Coal Co.	20.0	27.9
Jacobs Ranch	Kerr McGee Coal Corp.	14.0	16.7
Belle Ayr	Amax Coal Co.	19.0	15.5
Eagle Butte	Amax Coal Co.	20.0	15.4
Caballo	The Carter Mining Co.	12.0	14.3
Cordero	Cordero Mining Co.	15.0	12.9
Rochelle	Rochelle Coal Co.	11.0	12.0
Rawhide	The Carter Mining Co.	24.0	11.4
Caballo Rojo	Mobil Coal Producing	15.0	8.6
North Antelope	North Antelope Coal Co.	1.6	8.2
Buckskin	Triton Coal Co.	1.5	7.7
Wyodak	Wyodak Resources Development Corp.	5.0	2.9
Dry Fork	Dry Fork Coal Co.	8.0	0.8
Coal Creek	Thunder Basin Coal Co.	10.0	0.1
Ft. Union	Fort Union Coal Co.	1.2	0.0
North Rochelle	Shell Mining Co.	8.0	0.0
Clovis Point	Kerr McGee Coal Corp.	4.0	0.0
PROPOSED MINES ON EXISTING LEASES (AS OF 1981)			
Pronghorn	Mobil Coal Producing	5.0	0.0
East Gillette	Kerr McGee Coal Corp.	11.0	0.0
South Rawhide	Fort Union Coal Co.	7.0	0.0
Wildcat Creek	Gulf Oil Co.	10.0	0.0
Wymo	Wymo Fuels, Inc.	4.4	0.0
South Gillette	Peabody Coal Co.	2.0	0.0
Thunderbird	El Paso Energy Co.	3.5	0.0
Thunderbird II	Wold and Jenkins	5.2	0.0
Wildcat Creek Area	Consolidation Coal Co.	4.5	0.0
	SUBTOTAL	241.9	154.7
NEW TRACTS FOR 1982 LEASE SALE			
Rocky Butte	Northwestern Resources Co.	15.5	0.0
Timber Creek	NA	6.5	0.0
Keeline	NA	6.8	0.0
Kintz Creek	NA	8.1	0.0
Little Rawhide[1]	Amax Coal Co.	20.0	0.0
Duck Nest Creek[1]	Amax Coal Co.	10.5	0.0
Fortin Draw[1]	Wyodak Resources Development Corp.	5.0	0.0
Spring Draw[1]	Triton Coal Co.	14.3	0.0
	SUBTOTAL	86.7	0.0
GRAND TOTALS		**328.6**	**154.7**

[1] Leased as production maintenance tracts for existing mines.
[2] BLM, 1981
[3] Wyoming Coal Information Committee, 1991.

Table 6-5. Comparison Between Rocky Butte Mine Proposal as Assumed for 1981 Regional EIS and as Proposed by NWR

Item	Proposed Action from 1981 EIS[1]	Proposed Action for WRB EIS (excludes Option A)
Total strippable reserves (million tons)	502	625
Recoverable reserves (million tons)	452	608
Percent recovery	90	97
Mine life (years)	30	42
Annual production rate (million tons)	15.1	16
Mining method	truck/shovel	dragline and truck/shovel
Total disturbed area (acres)	5,000	7,333
Employment (peak)		
- during construction	230	279
- during mining	580	500
Water requirements (acre-feet per year)	318	320
Water supply wells destroyed	20	20
Particulate emissions (tons/year)	1,946 to 3,908	1,644 to 3,102
Maximum particulate concentration increase ($\mu g/m^3$ annual geometric mean)	55	43
Trains per year (round trips)	1,510	1,600
Maximum increase in vehicles per day (round trips)	243	250-300

[1] Information taken from Tract Profile for Rocky Butte Tract prepared by BLM as supporting document for the 1981 Round II Coal Lease Sale EIS.

Predicted employment requirements are similar for the two mine plans, with the 1981 EIS prediction slightly smaller during the construction period and about 16 percent larger during peak production.

Water requirements are similar for both predictions. The primary difference is that the 1981 tract profile predicted that a water-supply well would be drilled to a depth of 2,000 feet into the sub-coal Fort Union formation to provide 16 acre-feet annually (10 gallons per minute) of potable water. The NWR proposal assumes that potable water will be purchased from a bottled-water service and all other water requirements will be obtained by ground water collected in the mine, overburden dewatering wells, and surface runoff collected in sediment-control ponds.

Under both scenarios 20 water wells would be destroyed by mining activities. Air quality modeling done as part of NWR's permitting activities shows that particulate emissions should be less than what was predicted in the 1981 tract profile. Because coal production rates and predicted employment requirements are similar for the two scenarios, the predicted levels of train and vehicle traffic are also similar.

From the foregoing discussion it is concluded that the mine plan proposed by NWR, which would be enabled under the Proposed Action, is substantially similar to the hypothetical mine plan presented in the 1981 tract profile for the Rocky Butte lease tract. This hypothetical mine plan was incorporated into the 1981 regional EIS to evaluate both the mine-specific and cumulative impacts of the Rocky Butte mine.

Actual developments in the Campbell County coal mining industry, including coal production, disturbed acreage, and traffic, are within the ranges predicted in the four regional EIS's. Employment levels, and therefore population, are well below earlier predictions, an indication that productivity (in terms of coal produced per employee) is higher than was predicted a decade ago. Therefore many of the conclusions reached in the 1981 EIS, which ultimately led to the sale of the Rocky Butte lease tract in 1982, are still valid and even on the conservative side.

The following sections update the cumulative impact analyses for the Rocky Butte Mine in light of developments and changes that have occurred since the 1981 regional EIS was prepared and new data that are available from an additional 10 years of mining and reclamation experience in the region.

6.3 Geology and Mineral Resources

The Powder River Coal Region encompasses an area of about 20,000 sq mi and contains nearly 240 billion tons of subbituminous coal resources (BLM, 1979). The 127,000 acres in Campbell County within coal mine permit areas comprise about 1 percent of this region and contain about 3 percent of the coal resource. Campbell County has a total surface area of about 4,760 sq mi, of which some 4 percent is within current mine permit boundaries. The Eastern Powder River Basin, which includes all of Campbell County and a portion of Converse County, consists of approximately 7,800 sq mi (BLM, 1979).

Within the permit boundaries, the geology will be disrupted, with the coal recovered and the overburden and topsoil removed and replaced. The natural stratification of these shallower layers will be destroyed, and the replaced spoils will be a more homogeneous mixture of sands, silts and clays. The coal reserves mined represent a small percentage of the total resource but a large percentage of the shallowest (hence, most economically recoverable) reserves in the county and region.

6.4 Topography

After mining and reclamation are complete, the topography within about 1 percent of the Powder River Coal Region, about 2 percent of the Eastern Powder River Basin (EPRB) and about 4 percent of Campbell County will be flatter than before mining. The reduced relief and subdued topography can have benefits such as reduced erosion and increased precipitation infiltration. However, the flatter topography can be less attractive to some observers. Also, some topographic features can be beneficial to wildlife (e.g., breaks, incised drainages, rock outcrops and playas) and if not mitigated during reclamation design can result in loss of habitat on up to 4 percent of the county.

6.5 Soils

A total of approximately 111,000 acres on 19 mines including the proposed Rocky Butte mine (Table 6-2) will be progressively disturbed by surface coal mining. This represents approximately 2 percent of the entire EPRB. All of these areas will in time be reclaimed by planting appropriate species to restore soil productivity and prevent erosion, making the cumulative impacts to soils negligible.

6.6 Vegetation

Cumulative impacts to vegetation from strip mining were evaluated for the entire EPRB which encompasses all of Campbell County and the northern portion of Converse County (BLM, 1979). The analysis was based on information contained in the permits to mine for each mine in the Powder River Basin.

Cumulative effects of strip coal mining on vegetation within the EPRB will be negligible or minor because all mines are required to meet state reclamation success standards to obtain bond release (WDEQ-LQD, 1986). Furthermore, reclamation plans for all mines propose to replace the major types of vegetation originally found within

the permit area for the mine in the approximate acreage the types occupied prior to mining.

Collectively, the mines are projected to disturb about 111,000 acres, or two percent of the EPRB (Table 6-6). At the end of 1990, 31,744 acres (28.6 percent of the projected value and 0.6 percent of the EPRB) had been disturbed by coal mining. Of this disturbed land, about 9,200 acres had been reclaimed, leaving 22,540 acres disturbed. The proposed Rocky Butte Mine would add an average of 1,850 acres to this disturbance at any given point in time and would represent four to eight percent of the total disturbance. These values will fluctuate depending on production levels and reclamation schedules.

Table 6-6. Total Acres and Percentages of Projected and Actual Disturbance of Vegetation Types Within the Eastern Powder River Basin (EPRB), the Rocky Butte Permit Area, and Within the Total Permitted Acreage of All Mines in the EPRB, Converse and Campbell Counties, Wyoming.

	Projected Disturbed				Actual Disturbed to Date			
EPRB[1] (Acres)	Rocky Butte (Acres)	Rocky Butte (Percent of EPRB)	All Mines[2] (Acres)	All Mines (Percent of EPRB)	All Mines (Acres)	Percent of Projected Disturbed	All Mines (Percent of EPRB)	Area Reclaimed[2] (Acres)
4,978,560	7,333	0.1	111,000	2.2	31,744	28.6	0.6	9,199

[1] Source: BLM (1979)
[2] Data presented in this table were compiled from mine permits held by WDEQ, Cheyenne; and the permit, in preparation, for the Rocky Butte project. Due to variability in permit presentation of vegetation data, acreage presented herein represent a general summary of data for all mines in the EPRB.

Big sagebrush is the most common vegetation type in the EPRB, covering 84.1 percent of the land area of the region (Table 6-7). Ponderosa pine woodland, riparian areas, and cropland are next most abundant, occupying 577,328 acres, or 13.6 percent of the EPRB. Other vegetation types, such as greasewood grassland, lowland grassland, pasture, saline big sagebrush, scoria/roughlands and silver sagebrush, although uncommon, are also found in the EPRB.

Approximately 38 percent of all cropland in the EPRB disturbed by mining would be disturbed by the Rocky Butte mine. However, effects of losses of agricultural lands on regional productivity due to all mines, including Rocky Butte, would be minimal (Section 4.1.14). Because cropland is the principal vegetation type in the Rocky Butte project area, the contribution of Rocky Butte to impacts on other vegetation types is proportionally small.

While most vegetation types that will be impacted can be restored using conventional reclamation procedures, the scoria/roughlands type would be difficult to restore because the scoria buttes and ridges where the type occurs will be lost during mining. Thus, a cumulative effect of mining the EPRB will be the permanent loss of approximately 11,300 acres of scoria/roughlands type vegetation. However, Rocky Butte would not affect this type. Minor vegetation types, including those associated with saline soils or other areas where soil conditions are undesirable or difficult to duplicate, probably would not be restored. For example, there would be a net loss of approximately 1,100 acres of the saline big sagebrush type, 299 acres of which would be disturbed by Rocky Butte.

Due to a reduction in relief and in the number of vegetation types and plant species that would be reestablished, there would be a regional loss of vegetative diversity which would persist for years after closure of all mines. Geomorphic processes and natural succession would slowly create topographic and vegetative heterogeneity, such that permanent impacts to diversity would be minor or negligible.

Table 6-7. Areas and Percentages of Projected Disturbance of Vegetation Types within the EPRB, Rocky Butte Permit Area, and Within the Total Permitted Acreage of All Mines in the EPRB, Campbell and Converse Counties, Wyoming.

Vegetation Type	Acreage Occupied by Type, EPRB (Acres)	Disturbance of Type		Rocky Butte Portion of EPRB Disturbed (Percent)	Disturbance of Type		All Mines Portion of EPRB Disturbed (Percent)
		Rocky Butte (Acres)	Rocky Butte[2] (Percent)		All Mines[3] (Acres)	All Mines[2] (Percent	
Big Sagebrush and Upland Grassland	4,188,150	1,901	<0.1	<0.1	66,700	1.6	1.3
Cropland	124,464[4]	3,752	3.0	0.1	10,000	8.0	0.2
Disturbed	NA[5]	89	NA	<0.1	8,400	NA	0.2
Greasewood Grassland	82,960	0	0	0	1,100	1.3	<0.1
Lowland Grassland	NA	124	NA	<0.1	1,700	NA	<0.1
Pasture	NA	327	NA	<0.1	1,800	NA	<0.1
Riparian/Reservoirs	224,500	52	<0.1	<0.1	2,700	1.2	<0.1
Saline Big Sage	NA	299	NA	<0.1	1,100	NA	<0.1
Scoria/Roughlands	27,300	0	0	0	11,300	41.4	0.2
Silver Sage	36,900	789	2.1	<0.1	2,700	7.3	<0.1
Ponderosa Pine Woodland	328,400	0	0	0	0	0	0
Other Types	90,350	0	0	0	3,500	3.9	<0.1
TOTALS	4,978,560	7,333	–	0.2	111,000	–	2.2

1 Source: BLM (1979).
2 Relative to the acreage occupied by the type in the EPRB.
3 Data presented in the table were compiled from mine permits held by WDEQ, Cheyenne; and the permit, in preparation, for the Rocky Butte project. Due to variability in permit presentation of vegetation data, acreages presented herein represent a general summary of data for all mines in the EPRB.
4 Computed - Cropland occupies 2.5% of land in the EPRB (BLM 1979).
5 Data not available.

6.7 Water Resources

Surface coal mining affects both the surface- and ground-water systems. These effects have been monitored over the years of mining activity. The potential and actual extent of these effects have also been the subject of several regional studies. This new data is identified and assessed in this cumulative analysis.

6.7.1 Ground Water

The cumulative impact of surface coal mining on ground water is an issue which was raised during scoping conducted for the currently proposed coal leasing.

Concern over the effects of large-scale surface coal mining on ground water around the mines has resulted in the establishment of a monitoring program which is administered by the State of Wyoming. Each mine is required to monitor ground-water levels in the coal itself as well as in shallower aquifers in the area surrounding their operations. There are also requirements for drilling monitoring wells in the backfill areas of the mines in order to measure the recharge in these areas. The Gillette Area Groundwater Monitoring Organization (GAGMO), which was formed in 1980, assembles the hydrogeologic monitoring data collected by the coal mining companies operating in the EPRB of Wyoming, from the Buckskin Mine north of Gillette to the Antelope Mine in northern Converse County. GAGMO is composed of the companies with operating or proposed mines in that area, the Wyoming DEQ, the Wyoming State Engineer's Office, the BLM, and the OSM, which joined in 1991. Each year, GAGMO contracts with an independent firm to

publish the results of the monitoring for that year. In 1991 GAGMO published two reports, an annual report for 1990 and a ten-year report. The ten-year report summarizes the data accumulated during the last ten years of monitoring in the GAGMO study area (Hydro-Engineering, 1991). According to the GAGMO ten-year report, 646 monitoring wells were operated at 21 coal mine sites (seventeen active mines sites and four inactive or never-mined sites) in 1990. The Dave Johnston Mine located near Glenrock and the Rocky Butte lease are not currently part of GAGMO.

The major ground-water issues are:

- The effect of the removal of the coal aquifer and any overburden aquifers within the mine area, and replacement of these aquifers with spoil material.
- The extent of the temporary lowering of static water levels in the aquifers around the mine due to dewatering associated with removal of these aquifers within the mine boundaries.
- The effect of the use of water from the sub-coal Fort Union formation by the mines. Most mines in the PRB have water-supply wells completed in the sub-coal Fort Union formation.
- Change in water quality as a result of mining.

The cumulative effects of large-scale surface coal mining for each of these issues are discussed in the following paragraphs.

The effects of replacing the coal aquifer and overburden with a spoil aquifer is the first major ground-water concern. The following discussion of recharge, movement, and discharge of water in the spoil aquifer is excerpted from the Powder River Basin CHIA, a regional study of surface coal mining impacts in the Powder River Basin prepared by the USGS (Martin, et al., 1988):

The potential for recharge to the backfilled spoil would be greater than in areas not disturbed by mining. The natural bedding will be destroyed, creating a more isotropic condition in the spoil, resulting in generally greater vertical permeability than exists in undisturbed areas. The infiltration capacity of the backfilled and reclaimed spoil will be greater than that of the undisturbed Wasatch aquifer and Wyodak coal aquifer. However, the infiltration rate for reclaimed soils is less than that for natural soils due to the lack of root structure and other paths for vertical movement of water. After several years, infiltration rates for reclaimed soils will increase to approximately the same rates as for undisturbed soils. As infiltration rates increase to approximate premining conditions, ground-water recharge rates also will increase to approximate premining conditions.

Although the recharge potential of the reclaimed mine areas will increase, the actual recharge rate after reclamation probably will approximate or be somewhat greater than premining recharge. Actual recharge will depend on how well the surface contours are restored. A flatter average slope of the reclaimed land would increase the potential recharge by decreasing the rate of runoff from reclaimed areas. Recharge will increase locally where water is allowed to pond in surface impoundments. Also, some increase in recharge along re-constructed channels probably will occur during the infrequent periods of surface runoff.

Postmining recharge rates and mechanisms will not change in areas where lateral movement of ground water from adjacent clinker is a major source of recharge. This is because, in general, the clinker will not be disturbed by mining operations. After mining and reclamation have been completed, water will move laterally from clinker to the spoil aquifer.

Recharge to the spoil aquifer will be from infiltration of precipitation, lateral flow from the undisturbed clinker and the Wasatch aquifer and Wyodak coal aquifer, and leakage from surface-water impoundments and stream channels. Estimates of the time required for the ground-water system to re-establish equilibrium varies from a few tens of years to hundreds of years. The anticipated potentiometric surface of the spoil aquifer will resemble a composite of the premining potentiometric surfaces in the Wasatch aquifer and Wyodak coal aquifer. After equilibrium is re-established, ground-water flow patterns will approximate premining conditions. Discharge from the spoil aquifer will flow into the undisturbed Wasatch aquifer and Wyodak coal aquifer to the west (regional flow) or to reclaimed stream channels (local flow).

6.0 CUMULATIVE IMPACTS

According to the GAGMO ten-year report, 56 backfill monitor wells had been drilled as of 1990. The report listed the current water levels in these wells and compared them to the 1980 water-level elevations, which were estimated from the 1980 coal water-level contours. Of these 56 backfill wells, six (10.7 percent) were dry (the water levels in those locations were below the total depth of the well), 29 (51.8 percent) reported water at levels less than the water levels estimated for 1980, and 21 (37.5 percent) reported water at levels equal to or higher than those estimated for 1980. The presence of water in 89 percent (50 of the 56) of the backfill wells drilled as of 1990 indicates that recharge is occurring in the backfill.

Since reclamation is done concurrently with mining, and the monitoring data indicate that recharge of the backfill is occurring, it is not anticipated that additional significant impacts will occur as a result of the leasing proposed in the LBA's received to date nor in the opening of the Rocky Butte Mine.

Clinker, the baked and fused rock formed by prehistoric burning of the Wyodak-Anderson coal seam, is believed to be the major recharge source for the spoil aquifer, just as it is for the coal. Although some clinker is mined for road surfacing material, saturated clinker is not generally mined since abundant clinker exists above the water table and does not present the mining problems that would result from mining saturated clinker. There is little clinker in the Rocky Butte mine area. Therefore, the major recharge source for the spoil aquifer is not being disturbed by mining and will not be affected by the Rocky Butte Mine.

The second major ground-water issue is the extent of water-level drawdown in the coal and shallower aquifers in the areas surrounding the mines. Most of the monitoring wells reported by GAGMO (578 wells) are completed in the coal beds, in the overlying sediments, or in sand channels or interburden between the coal beds. These wells range from 9 feet to 420 feet in depth. The changes in water levels in the coal seams after ten years of surface coal mining are shown in Figure 6-1, which was taken from the 1991 GAGMO ten-year report. This map shows the actual area where drawdown in the coal seam has been greater than five feet in ten years in comparison with the predicted worst-case five-foot drawdowns derived from ground-water modeling done by the mines. Wyoming DEQ/LQD policy is to have the mining companies determine the extent of the five-foot drawdown contour. In general, drawdowns do not extend east of the mines because the mines are located on or near the coal outcrop line. The actual ten-year five-foot drawdown contours have not exceeded the predicted worst-case drawdowns in any of the mines, and, in most cases, the drawdown contours are well within the mines' predicted worst-case drawdowns.

Drawdowns extend farther in the coal than in the shallower aquifers because the coal is a confined aquifer and because it is areally extensive, whereas the shallower aquifers (sandstone in the Wasatch, alluvium, and clinker) are generally discontinuous and of limited extent. Therefore, the area in which the shallower aquifers have experienced a five-foot drawdown would be smaller in each case.

The actual five-foot drawdown levels are also well within the cumulative drawdown predicted by the USGS in the Powder River Basin CHIA (Martin, et al., 1988). This study predicts the approximate area of five-foot or more water-level decline in the Wyodak-Anderson coal aquifer which will result from all anticipated coal mining. All anticipated coal mining as referred to in the CHIA includes 16 surface coal mines operating at the time the report was prepared and six additional mines proposed at that time. The proposed mines include two mines which are now producing, one mine which did produce for a short time but is currently inactive, and the proposed Rocky Butte mine. The study assumes that water-supply wells in the coal may be affected as far away as eight miles from mine pits, although at this distance the effects would be minimal. Wells in the Wasatch are generally considered to be impacted by drawdowns only if they are within 2,000 feet of a mine pit (Martin, et al., 1988, p. 29).

Based on the above assumptions Martin, et al. (1988) show that there are about 3,000 wells in the area subject to impact by current and anticipated mining in Wyoming's Powder River Basin. Of these, about 1,200 wells are outside the actual mine areas (i.e., will not be removed by mining). About 1,000 of these wells supply water for domestic or livestock uses, and about 200 supply water for other uses. The remaining 1,800 wells are used by coal-mining companies: about 1,700 wells are monitor wells

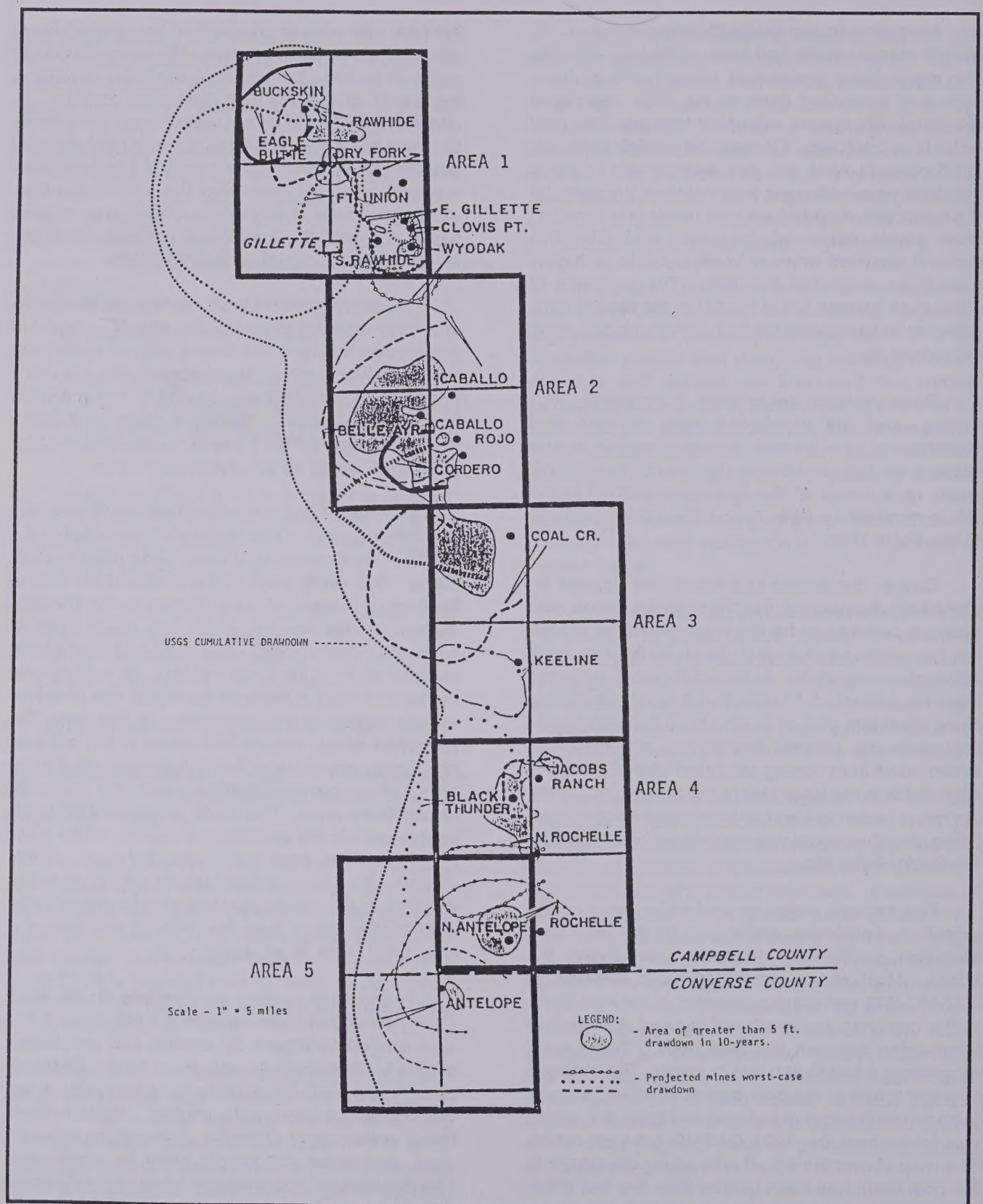


Figure 6-1. Comparison Between the 1990 Cumulative Drawdowns and the Mines Worst-Case and the USGS Predicted Drawdowns (Modified from Hydro-Engineering, 1991)

only, and the other 100 are used for water supply and/or dewatering at mine sites.

Of the 1,200 water-supply wells in the area potentially subject to impact, about 580 are completed in Wasatch aquifers, about 100 in the Wyodak-Anderson coal aquifer, and about 280 in strata below the coal. There is no completion data available for the remainder of these wells (about 240). They could be completed in any of the above aquifers.

Since the actual ten-year drawdowns lie well within the cumulative drawdown predicted by Martin, et al. (1988), the cumulative impacts to water wells have not reached the levels described in that report.

The USGS, in cooperation with the Wyoming State Engineer's Office, has recently completed an evaluation of ground-water level changes in the vicinity of Gillette (Crist, 1991). The study area for that report included an area of about 220 square miles around Gillette, where energy-related developments have caused a dramatic population increase since about 1960. This report states that water levels in the Wasatch formation around Gillette declined by about 9 feet between 1965 and 1974 and now appear to be rising. This is probably because the City of Gillette stopped using its Wasatch wells after 1981, when the city started using its Madison pipeline. Data from 18 observation wells completed in aquifers below the Wasatch indicate declining water levels. Pumpage for municipal use by Gillette and for public supply by local subdivisions is the principal cause of water-level decline from 1972 to 1985 in the upper Fort Union (i.e., the Fort Union from the base of the Wyodak-Anderson Coal down to 750 feet below that level). A water-level measurement in 1985 indicates that the water levels in this zone have stabilized. Water-level changes in the lower part of the Fort Union formation (i.e., more than 750 feet below the Wyodak-Anderson Coal) are not well documented due to a lack of data.

The additional ground-water impacts which would be expected as a result of extending mining as proposed in the LBA's received to date including the Rocky Butte mine would be to extend the drawdowns in the areas surrounding the proposed new leases. The actual drawdown contours for the mines which have proposed LBA's to maintain their current operations are well within the cumulative drawdown anticipated in the report by Martin, et al. (1988), and some recharge was already occurring in 14 of the 15 backfill wells which had been drilled by those mines by 1990. Therefore, additional significant impacts in water-level drawdown for the maintenance leases are not anticipated. The results of ground-water modeling of the Rocky Butte Mine is described in Section 4 of this EIS and includes cumulative impact analyses.

Potential water-level decline in the sub-coal Fort Union formation is the third major ground-water issue. According to the Wyoming State Engineer's records, fourteen mines hold permits for 42 wells which are between 400 feet and 10,000 feet deep. That number does not represent the actual number of wells potentially completed in the Tullock member, because the zone of completion of these wells is not always specified and not all of the wells are currently producing (for example, three of the permits are held by an inactive mine, and one of the wells Black Thunder has permitted has not been used since 1984).

Water-level declines in the Tullock member have been documented in the Gillette area. These declines are most likely attributable to withdrawal at subdivisions and trailer parks in and near the city of Gillette (M.A. Crist, USGS, written communication, 1987, in Martin, et al., 1988, p. 30). Most of the water-level declines in the sub-coal Fort Union wells occur within one mile of the pumped wells (Ibid). The mine facilities in the Powder River Basin are separated by distances of a mile or more, so little interference between mine supply wells would be expected. For the Rocky Butte Mine, it is anticipated that drinking water will be purchased from a bottled-water service and other water requirements will be met by overburden dewatering, pit inflows, and sediment-control ponds. A deep Fort Union well would be drilled only in the unlikely event that these sources prove insufficient.

In response to concerns voiced by regulatory personnel, several mines which have deep Fort Union water-supply wells have conducted impact studies of the sub-coal Fort Union formation. The OSM commissioned one cumulative impact study of the sub-coal Fort Union formation to study the effects of mine facility wells on this aquifer unit (McIntosh, et al., 1984). Kaman-Tempo (1983) performed a similar study for NERCO, and Western Water Consultants,

Inc. (WWC) performed similar studies for Amax (WWC, 1983a) and Phillips Coal (WWC, 1983b). Conclusions from all these studies are similar and may be summarized as follows:

- Because of the discontinuous nature of the sands in this formation, and because most large-yield wells are completed in several different sands, it is difficult to correlate completion intervals between wells.

- In some areas, most notably around the City of Gillette where the city and several subdivisions are utilizing water from this formation, regional water levels are probably declining. (Note: Gillette is using this water as a back-up source at this time.)

- Because large saturated thicknesses are available in this aquifer unit, generally 500 feet or more, drawdowns of a few hundred feet in the vicinity of a pumped well would not dewater the aquifer.

The mines adjacent to the currently proposed maintenance-tract LBA's all have permits from the State Engineer for deeper wells. Extending the lives of these mines would result in additional water being withdrawn from the Tullock member. The additional water withdrawals would not be expected to extend the area of water-level drawdowns over a significantly larger area because of such factors as leakance and recharge which tend to make drawdown curves asymptotic with time.

The Tullock member of the Fort Union formation is the lowermost unit in the formation, and it crops out at the surface east of the area being mined. Therefore, recharge to the Tullock member from the outcrop area is not affected by mining.

The fourth issue of concern with ground water is the effect of mining on the water quality. Specifically, what effect does mining have on the water quality in the surrounding area, and what are the potential water quality problems in the spoil aquifer following mining?

Ground-water quality in areas surrounding the mines is not impacted during mining. While the pits are open, ground-water flow directions are toward the pit, and there would be no mechanism for contaminants to migrate off-site even if contaminants were introduced into the ground water.

In the regional study of the cumulative impacts of coal mining, the median concentrations of dissolved solids and sulfates were found to be larger in water from spoil aquifers than in water from either the Wasatch overburden or the Wyodak-Anderson coal aquifer. This is expected because blasting and movement of the overburden material exposes more surface area to water, increasing dissolution of soluble materials, particularly when the spoil materials were situated above the saturated zone in the premining environment. On the basis of studies done in North Dakota, it was estimated that at least one pore volume of water must leach the spoil before the dissolved-solids concentration in the water would be similar to the premining dissolved-solids concentration (Houghton, et al., 1987). The time required for one pore volume of water to pass through the spoil aquifer is greater than the time required for the postmining ground-water flow system to re-establish equilibrium.

6.7.2 Surface Water

Cumulative impacts to surface water have not been mentioned as a source of concern during scoping conducted for the currently proposed coal leasing. However, there are two potential issues relating to cumulative surface-water impacts:

- Possible changes in runoff rates due to changes in precipitation infiltration rates.

- Possible changes in surface-water quality.

Some studies indicate that soil infiltration rates are smaller on reclaimed lands than on premining lands. A reduction of up to 29 percent has been found, with this reduction declining over time until the postmining infiltration rates recover to premining levels (Martin et al., 1988, p.106). However, the reduction in topography after reclamation will provide enhanced opportunity for precipitation infiltration and will probably more than offset this temporary decrease in soil infiltration rates.

Surface-water quality should not be significantly affected by mining based on studies conducted by the USGS for the Belle Fourche River Basin (Bloyd, et al., 1986, pp.33-41). Sediment yield should not

increase in area streams. Although reclaimed soils may be more erosive for the first few years after reclamation, the larger sediment production would not be delivered to area streams due to sediment deposition as a result of the flatter slopes on reclaimed lands and sediment trapping by mandated sedimentation ponds.

6.8 Alluvial Valley Floors

Effects on AVFs can include several of the ground and surface water changes listed above. Alluvial aquifers can be subject to water-table drawdowns, channels subject to changes in flow patterns, and the interaction between surface water and ground water can be altered. Impacts to designated AVFs are not permitted unless the AVF is insignificant to farming or unless the permit to affect the AVF was issued prior to the effective date of SMCRA. It is not anticipated that any AVFs will be affected by the Rockly Butte Mine.

6.9 Fish and Wildlife

Cumulative impacts to key wildlife species resulting from the proposed action and other mining activities in the area are presented in Table 6-8. Approximately 42,846 acres of sagebrush/upland grass habitat would be disturbed as a result of the proposed action and other coal mining activities within the 650,200 acres occupied by the Hilight pronghorn antelope herd (Table 6-8).

Table 6-8. Cumulative Wildlife Impacts from Surface Mining in the EPRB, Wyoming, 1991.

Species	Occupied Area (Acres)	Acreage of Disturbance Within Occupied Habitats (Rocky Butte/All Mines)	Percent Loss (Rocky Butte/All Mines)
Pronghorn Antelope	650,200[1]	6,917/42,846[2]	1.1/6.6
Mule Deer	1,968,000[3]	4,269/39,443[4]	0.2/2.0
White-tailed Deer	332,900[5]	52/2,700	<0.1/0.8
Raptors	3,596,355[7]	7,333/111,000	0.2/3.0
number of known nests	590[7]	6/50[7]	1.1/8.5
Sage Grouse	4,225,050[9]	4,347/69,400	0.1/1.6
number of known leks	28[11]	2/5[11]	7.1/17.8

[1] Hilight herd unit.
[2] Includes native and cropland vegetation types on all mine permit areas within the Hilight herd unit.
[3] Thunder Basin herd unit.
[4] Includes native and cropland vegetation types on all mine permit areas within the Thunder Basin herd unit.
[5] Thunder Basin herd unit and riparian habitat on the proposed Rocky Butte Mine permit area.
[6] Includes riparian habitat on all EPRB mine permit areas (see Table 6-7).
[7] Includes Campbell and northern ¼ of Converse counties (adapted from Phillips and Beske, 1990).
[8] Includes entire disturbed area of all mine permits in EPRB (see Table 6-6).
[9] Includes all sagebrush and upland grass vegetation types in EPRB (BLM, 1979).
[10] Includes all sagebrush and upland grass vegetation types on all mine permits in EPRB (see Table 6-7).
[11] Adapted in part from BLM (1979).

Only 6,917 acres (1.1 percent) of pronghorn habitat would be disturbed by the proposed Rocky Butte mine. Whereas this disturbance amounts to approximately 6.6 percent of the total herd area, it is likely that some areas within existing mine permits are classified by the WGFD as unoccupied by pronghorn, and many newly reclaimed areas at these mines are probably used by the species. Cumulative impacts to antelope resulting from the proposed action and other coal mining activities for the Hilight herd would be moderate for the duration of mining activities in the area.

Of the approximately 1,968,000 acres of mule deer occupied areas within the Thunder Basin herd, only 39,443 acres (2.0 percent) of suitable mule deer

habitat occur within existing and proposed mining operations (Table 6-8). Losses to the Thunder Basin white-tailed deer herd amount to less than 0.8 percent of the 332,900 acres occupied by that species. Only 4,269 acres (0.2 percent) of mule deer habitat and 52 acres (<0.1 percent) of white-tailed deer habitat would be disturbed by the proposed Rocky Butte project. Cumulative impacts to both mule deer and white-tailed deer populations would, therefore, be minor during the years that mining operations continue in the area.

Phillips and Beske (1990) quantified the number of active raptor nests at approximately 590 in Campbell and northern Converse Counties, Wyoming (Table 6-8). Whereas approximately 111,000 acres (3.1 percent) of the 3,596,355 acres in the region (7,333 acres on the Rocky Butte project area) and approximately 50 raptor nests (six on the project area, 5 active in 1991) would be disturbed as a result of the proposed action and other surface mining activities in the region, raptor mitigation measures identified in mine-specific permits, EA's and EIS's effectively reduce potential nesting losses to zero. Furthermore, only a portion of the 111,000 acres slated for disturbance would be disturbed at any one time, as reclamation would be an ongoing process.

Regarding sage grouse, approximately 69,400 acres (1.6 percent) of the 4,225,050 acres of sagebrush/upland grass habitat in the EPRB, and five (17.8 percent) of the 28 known leks would be disturbed as a result of the proposed action and other surface mining activities in the region (Table 6-8). Only 4,347 acres (0.1 percent) and two known leks (7.1 percent) would be disturbed by the proposed Rocky Butte mine. Since only a portion of the area would be disturbed at one time, habitat losses would be minor for the species. However, if only 28 leks occur in the EPRB and five of these leks would be disturbed, impacts to sage grouse could result from the combined effects of the proposed project with other surface mining activities in the region over the life-of-mine activities. Since many of the sage grouse leks in the area have been identified as a result of surveys conducted in conjunction with mine permitting activities, many of the known leks are associated with existing mining operations; numerous additional leks likely occur in the region that have not been identified. Additionally, some of the leks identified within disturbance areas may no longer exist, further reducing the potential cumulative impacts to the species.

Minor cumulative impacts from the proposed action and similar activities in the region could occur for some MBHFI (i.e., ferruginous hawk, golden eagle, and burrowing owl), T&E species (i.e., bald eagle), State sensitive/priority species (i.e., upland sandpiper), and other species breeding in the area (e.g., waterfowl, predators, etc.). The relatively small area (2.2 percent) of the EPRB impacted as a result of current and proposed mining activities in the area combined with standard practices limit impacts to these species.

6.10 Historical, Archeological and Paleontological Resources

All cultural resource sites that cannot be avoided must be mitigated. Thus, no cumulative impacts will occur.

6.11 Recreation

The additive effects of 18 existing coal mines and three proposed mines within the EPRB (including the proposed Rocky Butte Mine) could have major effects on recreational activities, such as hunting for the life of the mines. However, if hunting is limited or prohibited on mine sites, opportunities for wildlife observation may increase in some areas, concurrent with expected increases in wildlife abundance in areas prohibiting hunting.

Pronghorn antelope hunting is a major land use and deer hunting a negligible recreational activity for the Rocky Butte site. Total harvest figures for Rocky Butte are not available; however, a harvest of 1,119 antelope occurred on Hunt Area 24 (Table 3-6). About four percent (9,647 acres) of Hunt Area 24 (225,000 acres) is within the proposed mine site.

Six operating coal mines (Caballo, Belle Ayr, Caballo Rojo, Cordero, Coal Creek, and Jacobs Ranch) are within antelope Hunt Area 24 and mule deer/white-tailed deer Hunt Area 21. The total permit area occupied by the six mines is 54,150 acres, representing 24 percent of the land within Hunt Areas 21 and 24. However, only four percent of Hunt Areas 21 and 24 have been disturbed to date.

Each mine has the option of closing the entire site to hunter use or opening selected areas. Some mines currently do allow bow hunting and black powder (muskets) in some areas. If hunting is restricted or prohibited on major areas of the mine sites, herd sizes could exceed WGFD target values.

6.12 Air Quality

The TSP standard was based on all particle sizes which could be trapped using a high volume air pump and a particular type of filter. Recently, the federal standard was amended to account for the greater health risk due to particles less than 10 micrometers in diameter (the PM_{10} standard). The particulate standard change from TSP to PM_{10} is more lenient toward mining activities since mining produces mostly larger particles. Monitoring has indicated that at similar distances from the active pit, PM_{10} levels are roughly 30 percent those of TSP. The Wyoming DEQ has kept the 150 $\mu g/m^3$ 24-hour TSP standard in addition to the new 150 $\mu g/m^3$ 24-hour PM_{10} standard. The new annual average standard is 50 $\mu g/m^3$ PM_{10}.

Table 6-9 and 6-10 use the TSP standard in order to assess how well the previous regional impact assessments fit the current actual impacts. While it was not possible to predict with exact certainty which specific mines would be developed and what their sizes would be, the overall number and productivity of the mines in the Eastern Powder River Basin was projected for the period 1979 to 1990 with reasonable accuracy in the regional EIS's.

Particulate emissions are controlled by the amount of regulation imposed as well as by coal production. Actual emission rates are less than the projected emission rates since regulations have become more strict during this time period. In particular, treatment of haul roads and stockpiles, covering of conveyors, and more rapid revegetation of disturbed areas have become the norm rather than just being used in special cases.

As can be seen from Tables 6-9 and 6-10, the ambient concentrations across the region are usually well below past and current standards. With the major current standard being for finer particles which settle out more slowly, the area of potential cumulative impacts (the area where monitoring would pick up concentrations of 1 $\mu g/m^3$ as a result of all contributing sources) may be greater.

Since most large particles from mining processes drop out of the air quickly, cumulative impacts tend to occur only when the actual mine activities are within about 10 miles of each other. The trend over the past 10 years and with the currently proposed maintenance tracts is for activities at the mines to spread apart, increasing the distance between them.

Section 4.0 of this EIS presents an analysis of the cumulative impacts of the Rocky Butte Mine and neighboring mines on regional air quality. The selection of mines, time periods, and other modeling parameters was done in consultation with Wyoming DEQ.

6.13 Visual Resources

Cumulative visual impacts from other mines in the area would be nonexistent as far as Rocky Butte mine area is concerned due to local topography. Cumulative impacts would result from more of the area south of Gillette being visually impacted by mining activities, but this would be obvious only by driving throughout the area or observing it from the air, rather than from any given point on the ground surface. These cumulative impacts would be eliminated as the mines within the area cease operations and reclamation is completed.

6.14 Noise

Because of distances involved between mining operations, noise impacts are not expected to be cumulative.

6.15 Transportation Facilities

Cumulative effects of the Rocky Butte Mine on local and regional transportation facilities are addressed in Section 4.0 of this EIS.

6.16 Land Use and Ownership

Because all mines plan to restore mined lands to approximate premining land uses, most permanent cumulative impacts of mining on land use

Table 6-9. Particulate Concentration by Mine in the Eastern Powder River as Projected for 1990 and as Measured for 1990 for the Annual Ambient Air Quality Standard

Mine Name	Projected 1990 Annual Avg. TSP Concentration[1] ($\mu g/m^3$)	Measured 1990 Annual Avg. TSP Concentration[2] ($\mu g/m^3$)
Antelope	30-40	29
Belle Ayr	30-40	40
Black Thunder	30-40	46
Buckskin	20-40	33
Caballo	30-40	33
Caballo Rojo	30-40	29
Clovis Point	20-40	Idle
Coal Creek	30-40	22
Cordero	30-40	43
Dave Johnston	30-40	28
Dry Fork	20-40	28
Eagle Butte	30-40	32
Fort Union	20-40	29
Jacobs Ranch	30-40	40
North Antelope/Rochelle	30-40	31
Rawhide	20-40	30
Wyodak	20-40	29
AVERAGE[3]	20-40	33

[1] The technical report for the 1984 DEIS projected that mines south of Gillette would be between 30 and 40 $\mu g/m^3$ and those north of Gillette would span a greater range of between 20 and 40 $\mu g/m^3$.
[2] Wyoming DEQ.
[3] Average of all sites making measurements in 1990 with 40 or more observations.

in Campbell County would be negligible. Cumulative impacts on agricultural land uses due to construction and coal production would be minor or moderate (Table 4-3). Assuming that 20 percent of affected land in Campbell county would be affected in any given year, loss of production would range from 1,910 to 4,093 AUMs for cropland, or about three percent of the average crop production for Campbell County. Approximately 67 percent of the loss of production from cropland would occur due to the Rocky Butte project. Potential losses of grazing land and pasture land due to all mines would be 2,499 to 4,998 AUMs and 235 to 353 AUMs, respectively. However, the Rocky Butte project would contribute only five to six percent to these losses.

Table 6-10. Particulate Emissions by Mine in the Eastern Powder River Basin as Projected for 1990 and as Estimated from Actual Mining Activities in 1990

Mine Name	Projected 1990 Particulate Emission Rates (tons/year)[1]	Actual 1990 Particulate Emission Rates (tons/year)[2]
Antelope	NA	228
Belle Ayr	4520	2127
Black Thunder	3744	1912
Buckskin	1276	531
Caballo	3651	1126
Caballo Rojo	NA	2701
Clovis Point	1492	Idle
Coal Creek	3432	1383
Cordero	9241	2477
Dave Johnston	961	NA
Dry Fork	NA	750
Eagle Butte	3096	1101
Fort Union	NA	278
Jacobs Ranch	3149	1869
North Antelope/Rochelle	2318	471
Rawhide	2218	1388
Wyodak	682	338
Total	39780	18680

[1] PEDCo, 1983.
[2] Tentative figures from various regional EIS's, to be checked with the Wyoming DEQ.

There may be a net loss in residential land use in non-urban areas; however, growth in urban areas may be stimulated (Section 4.1.15). Because the Rocky Butte project would not affect oil and gas production or the operation of powerlines, pipelines, and other linear facilities, the project would not contribute to cumulative impacts on oil production or resource transportation in Campbell County. Similarly, Rocky Butte would not contribute to county-wide cumulative impacts on roads, because impacts would be mitigated during mining operations.

6.17 Socioeconomics

This section describes the cumulative socioeconomic impacts associated with the proposed project. Baseline, or without the Rocky Butte project, employment and population projections are presented for Campbell County. The baseline scenario is developed in order to evaluate

the incremental impacts associated with the project within the context of likely future socioeconomic conditions. Cumulative impacts were derived by adding the forecasted impacts of the project to the baseline conditions projected for the county.

6.17.1 Baseline Socioeconomic Projections

The Campbell County economy is currently dominated by mineral (primarily coal) and energy-related activity. Future baseline socioeconomic conditions of the county will reflect the influence of anticipated developments in these industries. For example, a further decline in the state's oil industry will influence employment prospects in Campbell County. However, recent federal Clean Air legislation appears to have heightened at least the short term market prospects for coal produced in Campbell County.

6.17.2 Mineral and Energy-Related Developments

In addition to the Rocky Butte project, a number of mineral and related developments are anticipated in Campbell County. The Dry Fork Mine, located northeast of Gillette, began operation in 1990 and produced about 815,000 tons of coal (Geological Survey of Wyoming, 1991). The output of the mine is dedicated to the coal requirements of the Laramie River Power Station. In 1990, 37 people were employed at the mine. However, during the anticipated life of the mine, an average annual level of 313 employees is expected (OSM, 1988).

Three new coal mines, in addition to Rocky Butte, have been proposed for Campbell County. These include the East Gillette Federal mine to be located east of Gillette and the Wymo and Keeline Mines to be located in southern Campbell County near the town of Wright. These mines are currently in various stages of the planning process. The East Gillette Federal mine is owned by Kerr-McGee. Wymo is owned by Kansas City Power and Light, and prospects for developing the project appear dim (Wyoming Geological Survey, 1991). The Keeline Mine, owned by Ranchers Energy, was in the permitting stage but has since been withdrawn. Employment levels arising from the development of these mines are unknown.

Campbell County leads all other Wyoming counties in oil production and ranks seventh in natural gas production. The outlook for oil production in Wyoming is not promising (Wyoming Oil and Gas Conservation Commission, 1991). At the state level, oil production has declined about four to five percent annually in recent years (Ibid.). This is due primarily to the age, 50 to 70 years, of the major oil fields in the state. Continued low oil prices have slowed exploration and will likely cause further declines in state and Campbell County oil production. Thus, employment gains for this industry are not anticipated; declines are more likely.

Black Hills Power and Light has proposed the construction of a new 80 megawatt generating station near the existing Neil Simpson station located east of Gillette (Black Hills Power and Light, 1991). The station is currently in the permitting and preliminary design phase. Construction is scheduled to begin in 1994 and last three years. A peak construction-phase work force of 300 to 400 persons is anticipated. The station is scheduled to go on line in 1997 and will permanently employ about 45 persons, most of whom will likely be Campbell County residents.

6.17.3 Baseline Employment Projections

Baseline employment projections were derived by the following process:

- Adjustment of current (1989) estimates of Campbell County employment by economic sector for county residency and full time employment equivalency (Stearns Catalytic Corporation, 1984).
- Adjustment of Wyoming Department of Administration and Information employment forecasts for Campbell County for residency and full time employment equivalency (Wyoming Department of Administration and Fiscal Control, 1988).
- Adjustment of projections for employment expansions in the mining sector which are not fully accounted for in the Wyoming Department of Administration and Information forecasts (Geological Survey of Wyoming, 1991).

The baseline employment projections indicate that between 1990 and 2000, the resident Campbell

County labor force will increase by nearly 5,000 persons, and resident, full-time employment will increase by about 4,200 jobs (see Table 6-11).

The annual unemployment rate is assumed to remain constant at about six percent during the forecast period.

Table 6-11. Projected Baseline Labor Force and Employment, Campbell County

Year	Projected Labor Force	Projected Employment	Percent Change Employment
1991	16,310	15,330	3.0
1992	16,820	15,810	3.1
1993	17,330	16,290	3.0
1994	17,830	16,760	2.9
1995	18,330	17,230	2.8
1996	18,830	17,700	2.7
1997	19,330	18,170	2.7
1998	19,830	18,640	2.6
1999	20,310	19,090	2.4
2000	20,790	19,540	2.4

The rate of employment growth is projected to slow during the forecast period. On average, county-wide employment is projected to grow at annual rate of 2.7 percent.

6.17.4 Baseline Household and Population Projections

Projections of occupied households and population were derived directly from employment and labor force forecasts. Households were estimated by assuming a worker-to-household ratio of 1.6. Population was estimated by applying a persons-per-household factor to the projected number of households. The number of persons-per-household in Campbell County in 1990 was 2.95. On the basis of recent historical trends, the number of persons per household is projected to decline to 2.90 by the year 2000 (see Table 6-12).

6.17.5 Cumulative Employment and Population Projections

This section presents the cumulative employment and population projections for Campbell County and the City of Gillette. Cumulative projections are composed of the previously described baseline projections and the direct and indirect employment and population impacts forecasted for the Rocky Butte project. The incremental impacts of the project are discussed in Section 4.1.15.

As a result of the project, employment in Campbell County would increase from 2.7 percent to 4.9 percent over baseline employment levels. With the proposed project, employment in the county would grow by nearly 3.3 percent annually during the forecast period (Table 6-13).

As a consequence of the proposed Rocky Butte Mine, the population level in Campbell County would exceed baseline conditions by nearly five percent in the year 2000. The population increase in Gillette would exceed baseline conditions by more than six percent by the year 2000 (Table 6-14).

Because nearly all direct mine employees and indirect service workers would reside in Gillette, the city would experience a proportionately larger impact relative to baseline conditions than the county as a whole.

Table 6-12. Projected Baseline Population, Campbell County and City of Gillette

Year	Campbell County	City of Gillette
1990	29,370	17,635
1991	30,010	18,006
1992	30,900	18,540
1993	31,790	19,074
1994	32,640	19,584
1995	33,520	20,112
1996	34,370	20,622
1997	35,210	21,126
1998	36,050	21,630
1999	36,860	22,116
2000	37,670	22,602

Note: The population of Campbell County is projected to increase by nearly 8,300 persons, or 2.5 percent annualy, during the period between 1990 and 2000. The City of Gillette's population is projected to increase by almost 5,000 persons during the same period.

Table 6-13. Cumulative Employment Impacts, Campbell County

Year	Employment	Percent Change over Baseline with Rocky Butte
1991	15,330	0.0
1992	15,810	0.0
1993	16,737	2.7
1994	17,448	4.1
1995	17,876	3.8
1996	18,440	4.2
1997	19,034	4.8
1998	19,442	4.3
1999	19,980	4.7
2000	20,504	4.9

Table 6-14. Cumulative Population Impacts, Campbell County and City of Gillette

Year	Campbell County Population	Percent Change over Baseline	Gillette Population	Percent Change over Baseline
1991	30,010	0.0	18,006	0.0
1992	30,900	0.0	18,540	0.0
1993	32,541	2.4	19,714	3.4
1994	33,830	3.7	20,599	5.2
1995	34,705	3.5	21,122	5.0
1996	35,725	3.9	21,777	5.6
1997	36,790	4.5	22,473	6.4
1998	37,514	4.1	22,878	5.8
1999	38,481	4.4	23,499	6.3
2000	39,423	4.7	24,097	6.6

6.17.6 Cumulative Economic Impacts

The principal economic impacts arising from the proposed Rocky Butte project would be increased employment opportunities, personal income and consumer expenditures and housing in Campbell County. The cumulative employment impacts are discussed above.

Under the baseline conditions, personal income (as measured by the U.S. Bureau of Economic Affairs in constant 1991 dollars) in Campbell County is projected to increase from about $500 million in 1990 to more than $640 million by the year 2000 (Wyoming Department of Administration and Information, Division of Economic Analysis, 1991b). As a result of the proposed project, personal income in the county would exceed baseline income by two to three percent during the forecast period.

Baseline retail purchases in Campbell County are forecasted to increase from nearly $134 million in 1990 to about $177 million by the year 2000. Retail spending by direct mine workers and indirect service workers would increase retail sales in Campbell County by about 2.6 percent to 3.3 percent over the projection period. Services purchased in the county, increasing from about $212 million in 1990 to more than $280 million in 2000, would experience similar percentage increases.

Currently, there is little available capacity in the Gillette area housing stock. Furthermore, housing demand in Gillette will increase by about 185 units per year under baseline conditions. To maintain an adequate housing stock, about 195 units should be added annually during the forecast period. As a consequence of the Rocky Butte project, an additional 525 housing units would be required by the year 2000.

Based on historical experience, most mine employees would prefer permanent, owner-occupied dwelling units. This would also likely be the case for the local service work force. The temporary construction work force would likely reside in temporary housing such as apartments and mobile homes.

Cumulative impacts on the housing market, especially the temporary housing market, could be a concern. The local housing industry will need to respond with sufficient lead times to larger demands than in the recent past.

6.17.7 Cumulative Infrastructure and Public Sector Financial Impacts

Annual average water use in Gillette is currently about 6.0 mgd. Assuming current water use patterns continue, average daily water use by the year 2000 could total 7.2 mgd. This represents a two percent increase over current usage and is not considered significant.

Peak period water demand could be a concern because actual peak use exceeds the system's design capacity by about five percent. However, the Gillette Utility Department staff believe that peak use can be sufficiently attenuated through practicable conservation measures.

Sewage treatment currently ranges from 2.2 to 2.5 mgd, well below the system's 4.0 mgd capacity. The system was designed to cost-effectively serve approximately 40,000 persons. Thus, the cumulative population growth projected for the city would likely not impact the system negatively.

The city-owned and operated electrical system currently has in place sufficient capacity to serve a peak of 40 megawatts. Capacity and other system expansions will likely be necessary to serve projected baseline population growth. The extent to which the incremental growth arising from the Rocky Butte project would impact the future operations of the system is not known with certainty, although it is believed to be moderate.

6.17.8 Public Safety

The Gillette Police Department is currently understaffed by five uniformed officers (Gillette Police Department, 1991). These and new positions will need to be staffed in order to provide police protection for the baseline population growth projected for Gillette. Assuming a ratio of 1.5 officers per 1,000 residents, the police department would require two additional officers as a result of the Rocky Butte project, and nine additional officers overall. Since this excludes the five officers the City presently lacks, staff increases will clearly be needed with or without the Rocky Butte Mine.

The rural portion of Campbell County is served by the Campbell County Sheriff's Department. Because most of the projected baseline and incremental population growth will occur in Gillette, additional resources required by the department will be relatively modest. However, the peak period construction work force may cause unique problems for the department (Campbell County Sheriff's Department, 1991).

Because the city-county fire department is funded largely through property taxes, it directly benefits by increases in county assessed valuation. Under baseline conditions, perhaps two full-time and 25 volunteer firefighters will need to be added to the department assuming the current ratio of personnel to population served. The incremental requirements due to Rocky Butte would be six additional volunteer firefighters.

6.17.9 Health Facilities and Services

The Campbell County Memorial Hospital is currently staffed by 30 physicians and a number of visiting physicians. Assuming the current ratio of one physician per 1,000 population, county baseline population growth will require eight additional physicians. One additional physician would be required as a result of the proposed Rocky Butte mine.

In addition to population levels, the mental health needs of Campbell County and Gillette are determined by a host of social factors over which little control can be exerted. However, mental health services in the county will likely expand in accordance with population growth (Northern Wyoming Regional Counseling Center, 1991). In comparison with baseline conditions, the additional requirements which might arise as a result of the proposed project would not be significant.

Several contradictory influences make forecasting social services needs complex (Wyoming Department of Family Services, 1991). For example, the expansion of job opportunities would imply a reduced need for social services such as AFDC. However, the prospects for landing lucrative coal mining jobs may attract job seekers who would require at least temporary assistance. On the whole, cumulative impacts could be a concern during the construction phase but should be manageable.

6.17.10 Educational Facilities

Enrollment in the Campbell County School District has fluctuated since the mid-1980's with no net increase since the 1986-1987 academic year. However, under baseline conditions, school enrollment is projected to increase by about 2.6 percent per year. The effect of the proposed project would be to increase annual enrollment above the baseline by four percent to 4.8 percent (see Table 6-15). Increased enrollment under the baseline may require the construction of new schools, but the incremental impact associated with the Rocky Butte mine would be negligible. With the county's high property tax base, sufficient funds should be available.

6.17.11 Public Sector Fiscal Conditions

The fiscal position of both the city and county governments is quite strong due to the prevalence of mineral-related revenues which is expected to continue into the future.

Under baseline conditions, mineral assessed valuation due to the expanded coal production is projected to increase by more than four percent annually between 1991 and 2000. The impact of the proposed project would be to increase mineral assessed valuation up to 4.5 percent beyond baseline conditions. Because nearly all of the Rocky Butte direct mine and local service employees are projected to settle in Gillette, the county should experience minimal, if any, budgetary impacts. Gillette does not directly benefit from mineral-related increases in assessed valuation. However, the city does receive a substantial amount of money from mineral royalties and severance taxes. In the past, the city has used these monies to cover cash shortfalls in certain enterprise funds. Furthermore, the city receives a substantial portion of sales and use tax revenues distributed in Campbell County. From a budgetary standpoint, the impacts associated with the proposed project would not substantially impinge on the city's fiscal position.

6.17.12 Cumulative Impacts on Social Well-Being

The social well-being of Campbell County residents relates to the ability of residents to maintain a desirable quality of life and is highly dependent on the availability of employment opportunities, access to public services and adequate health care and access to cultural recreational and other aesthetic resources.

The current social well-being of county residents could be considered good. Per capita income is among the highest in the state. County residents have access to a number of cultural and recreational amenities. Furthermore, the county economy is regaining ground lost in the mid-1980's, which was a priority for local citizens.

The proposed project would enhance the employment opportunities for county residents, and personal income would increase as the project begins operations. Furthermore, the mine presents an opportunity to attract long-term residents to the county which would add to the social stability of the community. These represent positive impacts on the social well-being of county residents.

Gillette was selected to host the National High School Finals Rodeo for a three-year period beginning in 1993. According to city officials, this is the largest rodeo in North America (David Spencer, 1991). In addition, the city will host the Cowboy State Games in 1991 and 1992. Both of these events will bring a large number of visitors to the area. In concert with baseline growth and projected growth associated with the Rocky Butte project, the delivery of certain services such as police protection and mobility could be significantly impacted. Temporary lodging may be problematic as the rodeo begins at the same time construction of the proposed project commences. Although potential impacts could result, they are short term in nature and should not be significant.

Table 6-15. Campbell County School District Enrollment

Academic Year	Baseline Enrollment	Cumulative Enrollment
1991-1992	8,135	8,135
1992-1993	8,382	8,608
1993-1994	8,622	8,968
1994-1995	8,870	9,193
1995-1996	9,110	9,480
1996-1997	9,350	9,782
1997-1998	9,590	9,991
1998-1999	9,822	10,267
1999-2000	10,054	10,536

7.0 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES AND SHORT-TERM USE OF ENVIRONMENT VS LONG-TERM PRODUCTIVITY

7.1 Irreversible and Irretrievable Commitment of Resources

For purposes of this section, the proposed action affects the commitment of a resource "irreversibly" when the current and/or potential productivity of that resource is lost and, once lost, cannot be regained (that is, the loss of this productivity cannot be reversed). The proposed action affects the commitment of a resource "irretrievably" when the current and/or potential productivity of that resource is lost during the life of the proposed action, but can be regained at some future time (that is, the loss of the productivity can be reversed).

The major irreversible commitment of resources resulting from the proposed action would be the mining and consumption of 608 million tons of coal to be used for electric power generation and other purposes during the 42 years of mining. An additional 18.75 to 31.25 million tons of coal resources lost during the course of mining would not be recovered during this period. There would be an irreversible commitment of petroleum, oil and lubricants during the life of the mine. Certain metals used in the construction of transmission lines and other facilities and in the manufacturing of mining equipment would be committed for the life of the mine but would be salvageable upon abandonment.

The quality, structure and characteristics of approximately 51.4 million cubic yards of topsoil located on 7,333 acres would be irretrievably changed by mixing. Soil formation processes, though continuing, would be irretrievably altered by these activities. Newly formed soil material would be unlike that in the natural landscape in the surrounding undisturbed areas; however, the productivity of the reclaimed soils would be at least equal to that of undisturbed soils and erosion potential would not increase materially.

Air quality would be irretrievably degraded and visibility irretrievably reduced by suspended particulates emitted during the life of the mine. These effects would be most pronounced during periods of calm weather and temperature inversions and most noticeable when mining operations are closest to the western and northern permit boundaries.

There would be an irretrievable commitment of surface- and ground-water resources during and after mining. Little change in surface-water quality is anticipated. TDS levels in the spoil aquifer are expected to be elevated for the long term, and it may take 100 years or more for water levels to achieve a postmining equilibrium and for the first pore volume of spoils water to be flushed out of the spoils. Both during and after mining, alternative sources of water would be required for these areas until the spoils aquifer can sustain water uses. Once the spoils aquifer resaturates and a steady-state flow pattern is established, water quality in the down-gradient coal aquifer may be temporarily degraded. Geochemical modeling by the USGS suggests that the coal aquifer may contain elements capable of improving the quality of the water flowing out of the spoils aquifer (Martin, et al., 1988, p. 93). Additional data are needed to confirm this.

Lowering of water levels would occur in the overburden and coal aquifers in the vicinity of the mine until mining is completed. The drawdowns would extend to the north and west; to the south they would be limited by the Caballo mine and to the east they would be limited by the coal outcrop. Drawdowns would extend out several thousand feet in the overburden and several miles in the coal, but would be insignificant at these extreme distances. Although the coal aquifer drawdowns toward the west (down gradient) of the mine become less important as the depth to coal increases (fewer wells are completed in the coal to the west), these drawdowns could persist for several years. Water levels would recover to premining levels in most cases after mine-related withdrawals cease.

7.0 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES AND SHORT-TERM USE OF ENVIRONMENT VS LONG-TERM PRODUCTIVITY

The cropland, grassland, and associated grazing and wildlife habitat that the affected lands provide would be irreversibly and irretrievably lost during the period of mining and reclamation. Some of the vegetation diversity would be irreversibly lost.

Loss of human life and disabling injuries could occur due to both the mining operations and vehicular traffic associated with the mining operations. This would be an irreversible and irretrievable commitment of human resources.

There would be an irretrievable and irreversible commitment of revenues generated by the mine by local jurisdictions to sustain levels of public services and facilities.

Disturbance of all known historic and prehistoric sites and paleontological resources on the mine site would be mitigated. However, any accidental destruction of currently known or unknown archeological or paleontological items would be irreversible and irretrievable.

Recreational services and facilities provided by local communities would be sustained through the life of the mine at current levels of demand which would be an irretrievable and irreversible commitment of these resources. Hunting and wildlife observation activities would be curtailed within the mine permit area until mining and reclamation are complete.

The natural topography of the area, which is already quite flat, would have even less relief and smaller average slopes after reclamation which would be an irretrievable and irreversible commitment of resources. The subdued relief on the permit area and other mine areas in the region could improve vegetative production and reduce erosion by increasing the precipitation infiltration rates, but the flatter topography may be visually less pleasing and detrimental to certain species of wildlife which rely on more dramatic topographic features.

7.2 Short-Term Use of the Environment vs Long-Term Productivity

At anticipated production levels, the Rocky Butte Mine would be committed to coal production and reclamation for 42 years. BLM considers the impacts of mining the proposed life of mine area to be short term if they would occur during these years and long term if they persist beyond 42 years.

Sale of the WRB tract to NWR, formation of an LMU and approval of a mining permit for the Rocky Butte Mine would enable mining of about 608 million tons of coal over a 42-year period to help meet national energy demands with a coal that is in compliance with sulfur dioxide emission standards. Although the Rocky Butte Mine would be a new mine, coal mining is already a major factor in the socioeconomic and environmental setting of Gillette and Campbell County. The Rocky Butte Mine would be adjacent to an existing mine, Caballo Mine, which is currently at the north end of a cluster of four adjacent mines along the north-south trending outcrop of the Wyodak-Anderson coal seam. The proposed Rocky Butte permit area is currently used for livestock grazing, dryland crop production, wildlife habitat and oil and gas production.

During the life of the mine, mining would result in the construction of additional roads, powerlines, fences and other facilities and structures in the area. Over the short term, mining would continue the process of change to the environment and commitment of resources. Over the long term, the area affected by mining would be reclaimed and returned to grazing land, dryland crop production, wildlife habitat and oil and gas production uses.

The coal removed from the Rocky Butte Mine represents nearly 8 percent of the coal currently under lease in the Wyoming portion of the Powder River Basin (7 percent considering leased coal and the 1.035 billion tons contained in six pending LBA's). A small amount of coal (3 to 5 percent or 18.75 to 31.25 million tons) would be unrecoverable due to normal mining losses.

The primary short- and long-term effect of mining on the hydrologic balance would be from the

7.0 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES AND SHORT-TERM USE OF ENVIRONMENT VS LONG-TERM PRODUCTIVITY

removal of the shallow aquifers within the permit area and from drawdowns in the shallow aquifers north and west of the mine for the short term. Resaturation of the replacement spoils may take several decades. Over the long term, water levels in the shallow aquifers would begin to recover to premining levels in most areas after mine-related withdrawals cease. There would be little change in the surface- and ground-water quality over the short and long term.

Visibility within the proposed permit area would be reduced and TSP and PM_{10} within and adjacent to the permit area would increase over the short term but remain within regulatory standards.

During mining, about 1,850 acres would be out of production at any one time. Within three to five years after revegetation, productivity would be restored. In the long term, soil productivity in the area would be suitable for premining uses of livestock and wildlife habitat.

Approximately 7,333 acres of land within the proposed permit area would be progressively disturbed by construction and mining during the life of the mine. During mining, about 1,850 acres would be disturbed at any one time. There would be long-term changes to the existing topography from backfilling and grading operations; however, the modified topography would support and in some places enhance the proposed postmining land uses of grazing, dryland crop production and wildlife habitat. Productivity of soils over the long term would return to or exceed premining productivity because the reclaimed soils would be more uniform in depth, texture and chemical and physical composition than the premining soils.

There would be loss of vegetation on the 7,333 acres and an accompanying disturbance of wildlife habitat, dryland crop production, grazing land and oil and gas production. Introduced and native grasses and shrubs and trees would be planted after mining to restore vegetation in the disturbed areas. BLM has determined that the mine site would be returned over the long term to an equivalent or better production capacity than that offered by the existing vegetation. In addition, although the productive capacity would be increased, the long-term support of the proposed postmining land uses would be dependent upon an adequate water supply.

Wildlife over the short term would be affected during the mining and reclamation period. Some of the species dependent upon the diversity offered by the current vegetation would be displaced by other wildlife species more adaptable to the new environment. Over the long term, wildlife would utilize the cover and habitat provided by the reclaimed vegetation areas. Other wildlife species would benefit over the short term from the sedimentation ponds and impoundments built during mining.

Mine related traffic would be sustained on the public roads outside the proposed permit area over the short term. Recreational use of the proposed permit area would be suspended over the short term until reclamation is completed. The demand for public recreation facilities provided by the surrounding communities would be sustained over the life of the mine.

Over the short and long term, knowledge of cultural resources and past lifestyles could decrease because vandals could destroy information, mining could destroy undiscovered sites, and current technology and methodology could cause researchers to overlook data that in the future may be important to the interpretation of past lifestyles. Without continuing identification, impacts on cultural resources would be long term and permanent.

Residents living close to the proposed permit area would continue to be subjected to noise from blasting and other mining activities. Long term effects would be diminished and eventually eliminated when reclamation is completed.

The short-term use of the environment would result in the project area changing from a Visual Resource Management Class IV to a Class V. In the long-term the area should return to its premining class IV status as a result of land reclamation and facilities removal.

Residual socioeconomic impacts stemming from the Rocky Butte Mine would relate primarily to the generation of jobs, income and revenue to the Campbell County economy which would continue

during the life of the mine and cease when the mine closes. The residual impact would be felt by those individuals and public entities which have made permanent investments or have otherwise come to rely on the mine's continuation. However, given the long mine life, these residual impacts suggest adequate time for amortization of such investment and lead time to adjust personal plans or other impacts when the time for mine closing arrives.

8.0 CONSULTATION AND COORDINATION

8.1 Team Organization

During the September 6, 1991 meeting of the Powder River Regional Coal Team, the decision was made for the Wyoming State Office of the BLM to proceed with the processing of the WRB lease application. The applicant, NWR, was instructed to meet with the BLM to plan and schedule the processing of the LBA and assure full compliance with NEPA. On September 30, 1991, during a meeting held at the BLM Wyoming State Office between representatives of NWR, BLM, OSM and the Wyoming Governor's Office, the decision was made to proceed with the preparation of an EIS.

The Wyoming State Director of BLM was assigned lead responsibility for the preparation of this EIS. OSM agreed to be a cooperating agency.

Jim Melton, BLM Coal Team Leader, was the project coordinator for this EIS. BLM provided professional specialists in the following disciplines: air quality, mine engineering, cultural resources, wildlife biology, range science, geology and economics. OSM provided review of the draft EIS by specialists in the fields of hydrology, mine engineering and reclamation. The U.S. Fish and Wildlife Service was consulted regarding MBHFI and T & E species and related wildlife issues. The State Historic Preservation Officer was consulted with respect to the findings of the cultural resources survey and mitigation plans.

The following consultant services were secured by contract. Western Water Consultants, Inc. (WWC) of Sheridan, Wyoming prepared the initial draft EIS, designed the mine and reclamation plan, and analyzed impacts to water resources, air quality, transportation, noise, geology and alluvial valley floors. Mariah Associates of Laramie, Wyoming under subcontract to WWC, prepared the sections dealing with soils, vegetation, land use, fish and wildlife, history, archeology, paleontology, recreation and visual resources. Browne, Bortz, and Coddington, Inc. (BBC) of Denver, Colorado, also under subcontract, prepared the socioeconomics sections of this EIS. Names of individuals who assisted with the preparation of this EIS are listed below.

WESTERN WATER CONSULTANTS, INC.

Doyl M. Fritz, P.E.	Project management, engineering, hydrology
Nick Tiffany, CPH	Surface-water hydrology, AVF
Scott Morton	Air quality, mine engineering
Mike Evers	Ground-water hydrology, modeling
Ray Oltion	Mine modeling
Mike Wolf	Geology, overburden
Bob Muller	CADD
Boyd Jensen	CADD

MARIAH ASSOCIATES, INC.

Phil Ogle	Coordinator
Karyn Coppinger	Vegetation and Reclamation Planning
Peter Guernsey	Wildlife
Jason Marmor	History
Craig Smith	Cultural Resources
Gary Brown	Cultural Resources
Patricia Fazio	Land Use, Recreaction
William Glenn	Soils
Brent Breithaupt	Paleontology

BROWNE, BORTZ & CODDINGTON, INC.

Edward F. Harvey	Socioeconomics
W. Ashley Ahrens	Socioeconomics

8.2 Consultation and Coordination

During the preparation of the draft EIS, members of the team consulted personnel from the following federal, state and local agencies:

- Bureau of Land Management
- Office of Surface Mining
- Soil Conservation Service
- U.S. Fish and Wildlife Service
- Wyoming Department of Environmental Quality
- Wyoming Department of Health and Social Services
- Wyoming Department of Revenue and Taxation
- Wyoming Game and Fish Department

- Wyoming Geological Survey
- Wyoming Governor's Office
- Wyoming Oil and Gas Conservation Commission
- Wyoming Recreation Commission
- Wyoming State Engineer
- Wyoming State Historical Preservation Office
- Wyoming Transportation Department
- Wyoming Department of Employment/Division of Research and Planning
- Wyoming Department of Administration and Information/Division of Economic Analysis
- Wyoming Department of Family Services
- Campbell County Engineer
- Campbell County Parks and Recreation Department
- Campbell County Sheriff's Department
- City of Gillette, Department of Utilities
- City of Gillette Police Department
- City of Gillette/ Campbell County Department of Planning and Development
- Job Service of Wyoming
- Gillette-Campbell County Airport
- Nature Conservancy
- Nickelson Little Farms
- Northern Wyoming Regional Counseling Center

Representatives of the following private industries and groups and the following individuals provided additional information:

- Amax Coal Company
- The Boardwalk
- Black Hills Power and Light
- Burlington Northern Railroad
- Chuck Rourke
- The Carter Mining Company
- Cordero Mining Company
- EnTech, Inc.
- Tri-County Electric Association

8.3 Coordination in the Review of the Draft EIS

Copies of this draft EIS are being sent to the following agencies and interested groups with requests for review and comments.

FEDERAL

Susan Anderson--Wy House of Reps.
Bureau of Indian Affairs--Norris Cole
Bureau of Land Management--Billings
Bureau of Land Management--Bob Janssen
Bureau of Land Management--Hillary Oden
Department of Energy--Dan Newquist
NPS Devils Tower National Monument--William Pierce
NPS Energy Mining & Minerals Division--Michael Duwe
Office of Surface Mining--Ranvir Singh
Office of Surface Mining--Jerry Ennis
Sen. Alan Simpson
US Fish & Wildlife Service--Art Anderson
US Fish & Wildlife Service--Gary Wood
US Fish & Wildlife Service Region 6--Kemper McMaster
US Geological Survey Mail Stop 972--Joseph Hatch
US Soil Conservation Service--Frank Dickson
USDI Fish & Wildlife Service--Steve Torbit
USFS, Medicine Bow National Forest
USFS, Thunder Basin National Forest
Sen. Malcolm Wallop

STATE

C-T Minerals Inc.
Sen. Hank Coe
Rep. William A. Cross
Department of Agriculture--Donald K Rolston
Sen. Jerry Dixon
Rep. Michael B. Enzi
Geological Survey of Wyoming--Dick Jones
Sen. Kelly Mader
Sen. John Perry
State Planning Coordinator--Allan Edwards
Gov. Stan Stephens
Tourism & State Marketing Division--R. D. Maxfield
Sen. Jim Twiford
Rep. Laurus L. Tysdal
University of Wyoming Field Representative
Rep. Dick Wallis
Wyoming Dept. of Commerce
Wyoming Dept. of Environmental Quality--Dennis Hemmer
Wyoming Dept. of Transportation--Don Diller
Wyoming Economic Development & Stabilization Board
Wyoming Game & Fish Dept.--Bill Helms
Wyoming Game & Fish Dept.--Bob Lanka
Wyoming Game & Fish Dept.--Olin Oedekoven
Wyoming Game & Fish Dept.--Pete Petera
Wyoming Geological Assoc.--Ron Baugh
Wyoming Geological Survey--Gary Glass
Wyoming Oil & Gas Conservation Comm.
Wyoming State Engineer's Office--Jeff Fassett
Wyoming State Historic Preservation Office--Tom Marceau
Wyoming State Land Commissioner--Howard Schrinar
Wyoming Transportation Department--Dave Hanlin
Sen. Russell Zimmer
Rep. Melvin Zumbrunnen

LOCAL

Big Horn County Planning Board--John Young, Chairman
City of Gillette--City Administrator
City of Gillette--Mayor

8.0 CONSULTATION AND COORDINATION

City of Gillette Dept. of Comm. Dev.--David Spencer
Converse County--Superintendent
Converse County Board of Commissioners
Gillette City Council--Mayor
Inyan Kara Grazing Assoc.--Wayne Christensen
Nickelson's Little Farms Water Co.
Powder River County--Tim Fletcher
Weston County Commissioners
Weston County School Superintendent

NATIVE AMERICAN ORGANIZATIONS AND INDIVIDUALS

William C-Hair
Dull Knife College
Crow Tribal Council Chairman
Northern Arapahoe Tribal Council Chairman
Northern Cheyenne Tribal Council--Danny Sioux
Northern Cheyenne Tribe Inc.--Edwin Dahle
Ogalala Sioux Tribal Council--Chairman
Bill Tallbull--Northern Cheyenne Cultural Committee
John Tarnesse--Shoshone Spiritual Leader

NON-PROFIT INTEREST GROUPS

Audubon Council of Wyoming--Charles Nations
Big Horn Audubon Society--Scott Posner
Cheyenne High Plains Audubon Society--Mark Gorges
Citizens Against Ruining the Environment--Marge Linderman
Douglas Chamber of Commerce--John Rider
Friends of the Bow
Gillette Chamber of Commerce
Medicine Wheel Alliance--Nicol Price
Murie Audubon Society--Bart Rea
Powder River Basin Resource Council---Chelsie Lee
Weston County Dev. Committee
Wyoming Heritage Society--Bill Schilling
Wyoming Multiple Use Coalition
Wyoming Outdoor Council--Stephanie Kessler
Wyoming Public Lands Council
Wyoming Wildlife Fed.--John Zelazany
Wyoming Wildlife Fed.--Mark Winland

PRIVATE INDIVIDUALS AND ORGANIZATIONS

The 312 Corporation
ABO Petroleum Corporation
A. M. Culver Company
Abraxis Production Corporation
Adah Macauley Trust Partnership
Samuel Adams
Burton J. Ahrens
D. Gene Albery
Nissim Alhadeff
AMAX Coal Company
American Oil & Gas Corporation
American Petroleum
AMPOL Exploration (USA) Inc.
AMPOLEX (Wyoming) Inc.
Andarko Petroleum Corporation
Anderson Minerals Ltd.
Andover Partners
John & Judy Andrikopoulos
Antelope Coal Company
Antelope Production Company
Apache Corporation
Mary Apple
Charles L. Ard
Axel Johnson Exploration & Production Company
Robert E. Bailey
Robert & Judith Barday
Robert & Molly Barlow
W.C.C. Barnes
James & Carol Bates
Bergen Oil Company
Betty Barnes Trust No. 1--William C.C. Barnes
Barry Doig Estate--Robert Piper, Personal Rep.
Lee M. Bass
Perry R. Bass
Robert M. Bass
Sid R. Bass
Beartooth Oil & Gas Company
Berco Resources
Glen Berger
Rod Bernasek
Kenneth & Angela Bertalot
Matthew T. Biggs
William Bishop
Kirk & Teresa Blackford
Blackhills Oil & Gas Corporation
Fred T. Blakeney
M. Robert Blakeney
Thomas L. Blakeney
Nellie A. Bliss
Lloyd & Katherine Block
Francis A. Bolen
Rebecca A. Boone
Douglas G. Boyd
Richard G. Boyd
Michael Boyle
Steve Brady
L. T. Braun
A. Wayne Breeland
Bridgeview Coal Company--Harry Wall
Forrest & Arline Brimmer
Francis Brown
William A. Buckovic
Jean R. & Doris Buell
Donald E. Burns
John & Sarah Burns
Neil Bush
Diana W. Butler
CNG Producing Company
C-T Minerals Inc.
Bruce Cabot
Carl & Katherine Callaway
Thomas R. Campbell
Cambria Oil Company
Alexander B. Campbell, V
Campbell County School Superintendent
Cardinal Petroleum Company
Oliver T. Carr, Jr.
Dorothy H. Carter
Frank C. Cassidy
Sara G. Cassidy
Celsius Energy Company
Chandler & Associates
Henry E. Chandler
Chevron USA Inc.
John & Joan Chorney
Cities Service Oil & Gas

8.0 CONSULTATION AND COORDINATION

City National Bank--Leo Terbieten Trust
Claire T. Blakeney Agency
Allen Clark
Glen L. Clark
Melvin D. Clark
Michael B. Clark
George & Dana Clay
Clifford J. Cloutier
Castal Oil & Gas Company
Columbia Gas Development Corporation
J. Mark Connally
Cordero Mining Company
Cramer Oil Company
Brenda J. Crowder
C. L. & Geraldine Culver
Alice E. Cundy
Cecil Cundy
Arnold Cunningham
Herma L. Czapla
D. L. Hannifin Family Trust
George M. Davis
DeCalta International
Fernando & Patricia DeLeon
Virginia DeLeon
Denver Expoloration Inc.
Harry & Erma DeSelms
Hazel DeSelms
Diamond Shamrock Company
Dice Exploration Company
Richard Dockter
Steven K. Dodds
Charles Steven Doe
Thomas G. Dorough
Frank & Bertha Dougherty
Dry Fork Coal Company
Don Duerr
Charles M. Duhon
Dunbar Well Services
Shirley M. Dymond
ETSI Pipeline Project
Eastern American Energy Corporation
Kathryn D. Edwards
ENRON Oil & Gas Company
Farm Credit Bank of Omaha
Farmer's Union Central
Felmont Oil & Gas Company
Glen Felt
Roger Felt
First Australian Resources Corp.
First Interstate Bank of Commerce
James M. Fitzpatrick, III
L. Phil Fleming
James P. Foraker
Fort Union Ltd.--Raymond W. Short
Ladd Frary
Richard & Mary Ann Frasch
David E. Frye
Betty Fyfe
GA-FCG 1986 Limited Partnership--c/o General Atlantic Energy Corp.
GAJH 1986 Limited Partnership
GAGLG Energy LP
Ralph & Mildred Galyen
Robert F. Garnin
Bill Gaulcy
General Atlantic Resources Inc.
Gail C. George
Geotech Production Inc.
Byron & Sarah Gibson
Lavonta Gilchrist
Albert O. Goddard
Richard & Carol Goerke
Kenneth M. Good
Edmond A. Gorek
Goldman Sachs Company
Charles M. Grace--Meyer Handelman Company
Jess & Helen C. Gray
Grayrock Corporation
Ray & Bernita Greeley
Jack & Elsie Greer
Olin C. Greer
Wilda B. Greer
William & Glenis Greer
Aren Griffith
Lysle A. Gust
HNG Oil Company
Jake Haas
Hamon Operating Company
Hampshire Energy
Bill & Peggy Hampton
Jerome R. Handran
John M. Handran
Thomas W. Handran
William E. Handran
Shawn P. Hannifin
Harkin Exploration Company
John S. Harrell
Harry R. Underwood & Associates
M. J. Harvey, Jr.
J. Floyd Hatch
Mary Ann Heaps
Earl M. Heater
Max E. Hentz
Heritage Mint Ltd.
Philip L. Herrington
John Hill, Sr.
Rep. John J. Hines
Jack & Blanche Hinman
Harold Hoffman
Hans E. Hohl
Timothy L. Hoops
Hrubetz Oil Company
Nancy E. Hussey
ILQ Inc.
William J. Isaacs
Izaak Walton League of America
J. Mill Iron Land Company
JNB Exploration Company
JNB Minnelusa Fund, Ltd., 1983-A
Kathryn P. Jackson
John E. Jacobs
James Cassidy Smith Inc.
Dorothy F. Jasper
William E. Jeffers
Morris & Loretta Jennings
Jerry Chambers Exploration Company
Jim's Water Service
Emmett Johnson
H. L. Johnson
Steven & Debora Johnson

8.0 CONSULTATION AND COORDINATION

James & Joyce Johnston
James B. Judd
Joel Jurgens
K. W. Bergner & Co.
Kaiser Energy Inc.
Clinton & June Kellgreen
Kerr-McGee Corporation
Richard & Diane King
Major Donovan Kirkpatrick
John C. Kirkpatrick
Marshall D. Knots
Karl F. Koch
Curtis & Georgia Kofoed
Marvin E. Kraft
Albert G. Kutz
Betty Jean Kutz
Susan D. Kutz
L-K-E Inc.
Ladd & Lukowicz, Inc.
Lancaster Corporation
Lario Oil & Gas Company
Demetra Larremore
Patsy L. Larson
Tracy & Adelaide Larson
LASMO Energy Corp.
Latex Petroleum Corporation
Thomas B. Leary
William R. Leer
Clifford Long
Louisiana Land & Exploration Co.
N. B. Loundagin
Eric C. Ludvigsen
Karl E. Ludvigsen
Bryce Lundell
Kelly McBride
McBride & Thames
Ed McCaffree
Robert K. McCormack
McFarland Energy Inc.
Betty Ann McGee
Daniel W. McGee
Rusty & Tina McGee
Thomas D. McGee
J. R. & Rubye F. McKibben
Joseph K. McMahon
Francis V. McPike
M. L. Associates
MYCO Industries
Robert & Daisy MacIntosh
Harold Mader
Louis S. Madrid
Rolf A. Malmquist
Hubert T. Mandreville
Mike & Carolyn Manley
Robert L. Manning
Kit L. Maris
Markwest Energy Partners Ltd.
Marshall & Winston Inc.
Marshall Energetics, Inc.
Bruce Martens
Lola B. Martin
Marvin Martin
Loleta Martinez
Zonimir & Mary Ann Martinovich
Maynard Oil Company
Meadowlark Farms Inc.
Teresa Meckler
Meridian Oil Inc.
Bernard Messinger
Janice D. Meyer
Robert R. Michlin
MidCon Exploration Company
Frances E. Miller
Harvey & Gladys Miller
Larry K. Miller
Mining Association of Wyoming--Bob Holcomb
Misty "B" Corp.
Mobil Coal Producing Inc.
W. A. Moncrief
Albert W. Moore
Steven & Sherry Moore
Morenergy Exploration
Jessie M. Morrow
Douglas D. Mounce
Mountain States Telephone & Telegraph Company
Mule Creek Oil Company
Richard M. Mullen
Robert B. Mullen
John R. Munford
Murphy Operating Corp.
William Murphy
NBB Oil & Gas Partners (USA)
Evans Nash
National Coal Association--Marty Rogers
Nell Hecomovich
Charles M. Newman
Randall H. Nichols
NICOR Exploration Company
Henry S. Noble
Theodore N. Noel
Norex, Inc.
Northwestern Mutual Life Insurance Co.
Nuevo Sies Inc.
R. K. O'Connell
Michael W. O'Shaughnessy
Theodore & Jan Obenchain
Odyssey Partners Ltd.
Old South Royalty Company
Helen Ruth Oliver
W. L. (Bill) Orister
Axel & Rosemary Ostlund
Donald N. Page
Panhandle Eastern Pipeline Company
David B. Park
Mary Louise Patterson
Peak Resource Management, Inc.
Charles W. Peck
Frank & Marion Pedric
Jim & Laura Pedric
Joseph & Betty Pedric
Thomas L. Pedric
Maxine E. Peebles
Michael S. Perry
James H. Peterson
Peggy Peterson
Petrolex 86
Petrolex Corporation
Kerry L. Phelps
Phillips Petroleum Company
Robert M. Pickard

8.0 CONSULTATION AND COORDINATION

David N. Pierce
Plains Petroleum Operating Company
Presidio Exploration Inc.
Price Oil & Gas Investments Trust
Prima Exploration Inc.
Louis & Ann Prosch
Puckett Investment Company
Bernard M. Ramsay
Ranch Oil Company
John J. Redfern, III
C. R. Reiter
Colleen Reynolds
Kathy Richard
Dwight A. Rigney
Lester & Anna Mae Rigney
Robert & Karen Rigney
Arthur E. Risley
Howard Robb
James & Mary Robb
John Robb
William & Kathryn Robb
Eugene L. Robbins
Thomas L. Robbins
Robert C. McGhee Estate
Corbin J. Robertson
Elizabeth L. Robinson
William T. Rogers
Ronadero Company Inc.
Stephen Rooth
Carrole Rosenbloom
Bernard C. Rourke
Paul D. Rourke
Lura L. Rouzer
Laverne & Barbara Rude
SBL Resource Management
SHV Oil & Gas Company
Andrew Sabin
Robert Sabin
John & Helen Sampson
Santa Fe Energy Operation Partners LP
W. James Saul
Paul F. Sawyer
Paul E Schnurr
Seabrook Corporation
Larry Seright
S. Craig Settle
Sid & Ardyth Severson
Wesley & Dorothy Severson
Shakespeare Oil Company Inc.
Craig Shanor
Shaw Resources Inc.
James Sheidenberger
Malcolm & Loralei Shepard
William H. Short
Shrevebel Corporation
Gary & Nancy Siebold
Rep. Marlene Simons
Charles T. Slack
Donald C. Slawson
D'Lo Smith
Furman F. Smith
Harry P. Smith
Hester M. Smith
Michael L. Smith
Robert & Viola Smith
Stephen Smith
Wendall & Elaine Smith
Margaret B. Spies
Star Exploration
Joseph S. Sprinkle
Sterling Montana Inc.
Richard B. Stevens
Bert Storall
Sun Exploration & Production Company
Sunset Realty Corp.
Swift Energy Company
John B. Syptak
TFS Trust
TXP Operations Company
Taurus Exploration USA Inc.
Jewell T. Taylor
Joyce S. Taylor
Texaco Producing Inc.
Rep. William M. Tibbs
Thomas G. Dorough Trust Partnership
M. Ray Thomasson
Thru-Line Inc.
Thunder Basin Grazing Assoc.
Thunderbird Exploration
Steve A. Tofte
Gladys M. M. Totsch
Tri-County Electric Association
David True
True Oil Co.
Fred E. Tucker
Forrest Twilford
Tyrex Oil Company
United Mine Workers Assoc.--Bob Guilfoyle
Cat Urbigkit
Gordon S. Utter
Grady H Vaughn, III
Robert P. Vernon
Victoria Exploration Inc.
Vintage/P Limited Partnership
W. A. P. A.
WDS Petroleum Ltd.
John Wall
E. D. Wallace
Dwight & Carolyn Wallam
James P. Wason & Nancy Cohen
Thomas L. Watson
Jean M. Wenande
Western Water Consultants--Doyl Fritz
Marilyn M. Wheelhouse
Whiting Petroleum Corporation
Sam D. Winegrad
James & Jennifer Winter
Jeanne F. Winter
Haman Wise
Debbie Wold
William M. Wolf
Donald & Dorothy Wolff
Gary C. Wolff
Keith R. Wolff
Kenneth R. Wolff
Louis F. Wolff
Loverretta A. Wolff
Nancy K. Wolff
William J. Wolff
Alice Manning Wray

Wright Chamber of Commerce--Gary Kipp
Laneil Strapp Wright
Wyodak Resource Development Corp.
Wyoming Banker's Assoc.
Wyoming Mining Assoc.--Marion Loomis & Jack Ratchye
Wyoming National Bank of Gillette
Wyoming Stock Growers--Bob Budd
Wyoming Wool Growers Assoc.--Carolyn Paseneaux
Robert A. Yarber
Zimmerman Resources Company

Scoping for the EIS was initiated on October 4, 1991 with the mailing of a Public Notice of Comment Period to over 650 persons and organizations. This list includes all persons and organizations known to have an interest in BLM's coal leasing activities. A Notice of Intent (NOI) to prepare the EIS was published in the Federal Register on October 9, 1991. A public scoping meeting was held in Gillette, Wyoming on October 22, 1991. The public comment period for the scoping process remained open until November 1, 1991.

The public scoping meeting was attended by residents of dwellings near the Rocky Butte and WRB lease tracts and by representatives of other regional mining companies, in addition to BLM and NWR representatives and the contractors preparing portions of the EIS. BLM personnel conducted the meeting and opened with a description of NWR's mining proposal and a historical perspective of the coal leasing program in the Powder River coal region. The LBA process, and the situation of the WRB tract with respect to that process, were explained by BLM. BLM personnel explained the BLM leasing process, including the regional leasing process and the LBA process which is in effect since decertification of the RCT due to declining interest in regional leasing activity.

The tentative schedule for the WRB lease sale and EIS process were described to the October 22, 1991 meeting attendees, and opportunities for public input into the process were explained. Following BLM's presentation, the meeting was opened for public discussion and identification of issues. Comments were offered only by nearby residents. The following is a brief synopsis of these comments and questions.

- What will happen to adjacent property owners? Will there be another situation like the one that occurred at Rawhide Village? How will blasting affect water wells and structures? Will property values decline as a result of the new mining operation? Will it be necessary to relocate Highway 59?
- Will Section 6, T.48N, R.71W, be mined?
- How will adjacent land uses be affected? Will people be relocated? Will livestock and wildlife uses be affected?
- What is the one-half mile "permit buffer" for? This includes a large number of houses.
- The Nickelson Little Farms Subdivision is just north of the proposed facilities area. Will there be noise and traffic impacts at this subdivision?
- How will air quality be affected?
- When will mining operations start?
- What mining methods are proposed?
- The mine plan map shows an overburden storage area in the northwest corner of the mine area. How large will this stockpile be and how will dust be controlled?
- How will blasting be controlled so houses along the east side of Highway 59 are not adversely affected? Blasting from the Caballo Mine is noticeable in this area. Who pays for pre-blast surveys?
- How will solid waste from the mine be handled?
- Will the access road be paved? How about the Four Corners County Road?
- What will be the effect on the fox farm nearby? These animals are sensitive to any disturbance.

8.4 Where Copies Can be Inspected

Copies of the draft will be available for public review at Bureau of Land Management offices throughout Wyoming and at public libraries in Campbell, Natrona, and Sheridan counties. Single copies are also available upon request from the Bureau of Land Management in Casper, Wyoming as long as supplies last.

REFERENCES

SOURCES CITED

Arbogast, W.R.

n.d.: Archaeology of the Eastern Powder River Basin, Wyoming: A Synthesis (Final draft report). Prepared for Wyoming State Historic Preservation Office.

Barbour, M.G., J.H. Burk, and W.D. Pitts

1980: Terrestrial Plant Ecology. Benjamin/Cummings Publ. Co., Inc. Menlo Park, California. 60 pp.

Basford, Dan

1991: Burlington Northern Railroad, verbal and written report on BNR operations near Gillette, Wyoming, November.

Boulder Exploration Group

1989: "Powder River Basin Coal Supply and Demand 1990 Update", BXG Incorporated, Boulder, Colorado, November.

Breckenridge, Roy M., Glass, G., Root, Forrest K, and Wendall, William G.

1974: Campbell County - Geologic Map Atlas and Summary of Land, Water and Mineral Resources: Geological Survey of Wyoming, County Resource Series No. 3.

Breithaupt, B.H.

1991: Results of the Paleontological Survey of the Proposed Rocky Buttes Coal Mine Permit Area, Campbell County, Wyoming.

Bureau of Land Management

1974: Final Environmental Impact Statement, Eastern Powder River Coal Basin of Wyoming.

1979a: Final Environmental Impact Statement Eastern Powder River Coal.

1979b: Final Environmental Impact Statement: Proposed Development of Coal Resources in Eastern Powder River, Wyoming.

1980: Visual Resource Management Program. U.S. Government Printing Office. Washington, D.C. 39 pp.

1980: "Amendment to Wyoming Land Use Decisions: Eastern Powder River Basin Area Management Framework Plan: Gillette Review Area." Casper, Wyoming.

1981: "Powder River Region Coal Final Environmental Impact Statement." Casper, Wyoming, BLM Casper District Office. Includes individual tract profiles.

1983: "Powder River Coal Regional Tract Summaries." Cheyenne, Wyoming.

1983: "Affected Environment: Technical Report on Air Quality in the Powder River Coal Region." PEDCo Environmental Inc. for Bureau of Land Management, Casper, Wyoming.

1984: Buffalo Resource Area Resource Management Plan, Draft Environmental Impact Statement, Buffalo, Wyoming.

1984: "Draft Environmental Impact Statement for Round II Coal Lease Sale in the Powder River Region." Casper, Wyoming.

1985: "Buffalo Resource Area, Resource Management Plan (RMP)." October 5, 1985.

1990: "Coal Bed Methane Environmental Assessment, Eastern Campbell County and Western Johnson County, Wyoming WY-061-0-EA064." Casper BLM, March 1990.

1991a: "Jacobs Ranch Federal Coal Lease Application Environmental Assessment." Casper BLM, June 1991. EA# WY-061-1-062. Environmental Assessment for Coal Lease Application WYW117924.

1991b: Draft Environmental Assessment for the West Black Thunder Coal Lease Application. Casper BLM, October 1991. EA# WY061-2-004.

Bureau of the Census

1983: *General Social and Economic Characteristics - Wyoming.*

1989-90: "Current Population reports, Population Estimates and Projections Series P-25, No. 150, State Population and Household Estimates." by Edwin Byerly, U.S. Department of Commerce, July 1989.

Bureau of Economic Analysis

1991: *Survey of Current Business,*, Volume 71, Number 9.

Carson, Bill

1991: Personal communication, Public Works Director, City of Gillette, October.

Carter Mining Company, The

1985: Mine Permit Application Package for Caballo Mine, submitted to Wyoming DEQ/LQD.

REFERENCES

City of Gillette

1990: Department of Community Development, Planning Division, *1990-1991 Land Use Inventory, Volume I – Housing and Demographic Estimates.*

1991-92: *Financial Management Program for the City of Gillette, Wyoming, Fiscal Year 1991-92.*

1991: Department of Community Development, Planning Division, *City of Gillette 1991 Citizen Survey.*

Cook, C.W., R.M. Hyde, and P.L. Sims

1974: Revegetation Guidelines for Surface Mined Areas. Colorado State University Range Science Series No. 16. Ft. Collins. 73 pp.

Daddow, P.S.

1986: *"Potentiometric-Surface Map of the Wyodak-Anderson Coal Bed, Power River Structural Basin, Wyoming, 1973-84."* USGS Water-Resources Investigations Report 85-4305, Scale 1:250,000.

Eckles, D.G., R. Blatchley, and J.L. Hauff

1980: Final Report on the Archaeological Investigations Conducted in the Carter Mining Company's Caballo Mine, Campbell County, Wyoming. Prepared for Carter Mining Company. Office of the Wyoming State Archaeologist, University of Wyoming, Laramie.

Employment Security Commission of Wyoming

n.d. Research and Analysis Section, *Covered Employment and Wage Data by Industry and County: 1985-1987.*

Environmental Studies Board

1974: Rehabilitation Potential of Western Coal Lands. Study Committee on the Potential for Rehabilitating Lands Surface Mined for Coal in the Western United States. National Academy of Sciences, National Academy of Engineering. Ballinger Publ. Co., Cambridge, Massachusetts. 198 pp.

Federal Interagency Committee for Wetland Delineation

1989: "Federal Manual for Identifying and Delineating Vegetated Wetlands." US Army Corps of Engineers, US Environmental Protection Agency, US Fish and Wildlife Service, and USDA Soil Conservation Service, January 10, 1989.

1991: Ibid. Revised Draft, April 26th, 1991.

Fenneman, N.M.

1931: *"Physiography of the Western United States,"* McGraw-Hill Book Co., New York, 534 pp.

Floodman, M.G., and P.D. Friedman

1983: A Cultural Resources Inventory of Portions of the Texas Energy Services, Inc. Rocky Butte Coal Mine Lease Tract, Campbell County, Wyoming. Prepared for Texas Energy Services, Inc., Gillette. Powers Elevation, Denver.

Frison, G.C.

1971: "The Buffalo in Northwestern Plains Prehistory: Site 48CA302, Wyoming." American Antiquity 36(1):77-91.

1978: *"Prehistoric Hunters of the High Plains,"* New York, Academic Press.

Fullerton, David S.

1977: *"Surficial Geologic Map of the Coyote Draw Quadrangle, Campbell County, Wyoming."* U.S. Geological Survey, Miscellaneous Field Studies, Map MF-895, Scale 1:24,000.

Fullerton, David S., Kirkham, Robert M.

n.d. *"Surficial Geological Map of the Gap Quadrangle, Campbell County, Wyoming."* U.S. Geological Survey, Miscellaneous Field Studies, Map MF-897, Scale 1:24,000.

Geological Survey of Wyoming

1990: "Wyoming Geo-Notes No. 26.: Issue of May 1990, Geological Survey of Wyoming.

1990: "Wyoming Geo-Notes No. 28." Issue of November 1990, Geological Survey of Wyoming.

1991: "Wyoming Geo-Notes No. 30." Issue of May 1991, Geological Survey of Wyoming.

1991: June 26th, 1991 interview, Dick Jones, Laramie, Wyoming.

Groenwold, G.H.

1979: *"Hydrologic and Hydrogeochemical Characteristics of Selected Strip Mine Spoils in Western North Dakota,"* in Wali, M.d., ed., Ecology and Coal Resource Development Symposium, Proceedings: New York, Pergamon Press, pp. 685-692.

Hall, et al.

1981: *"Aboriginal Settlement Within the North Antelope Coal Properties in Southern Campbell and Northern Converse Counties, Wyoming."* D. Hall, J. Grady, and T. Lennon, Western Cultural Resource Management, Inc., Boulder, Colorado.

REFERENCES

Harner-White Ecological Consultants, Inc.

1980: Sage Grouse Strutting Ground and Raptor Nesting Surveys of the Rourke-AMAX and AEP State Properties. Prepared for Texas Energy Services by Harner-White Ecological Consultants, Inc. 9 pp.

Hauff, J.L., and D.G. Eckles (ed.)

1982: The Carter Mining Company's Caballo Mine, Campbell County, Wyoming: Cultural Resource Mitigation Within the Permit Area, 1981. Prepared for Carter Mining Company. Office of the Wyoming State Archaeologist, University of Wyoming, Laramie.

Houghton, R.L., et al.

1987: "*Hydrogeochemistry of the Upper Part of the Fort Union Group in Gascoyne Lignite Strip-Mining Area, North Dakota.*" Houghton, R.L., D.L. Fisher, and G.H. Groenewold. USGS Professional Paper 1340, 104 p.

Hydro-Engineering

1991a: "1991 GAGMO Annual Report", March.

1991b: "GAGMO 10-year Report:, March.

Kaman-Tempo

1983: "Final report - Revised Cumulative Hydrologic Impact Assessment, Antelope Mine." Kaman-Tempo, Denver, Colorado, for NERCO Coal.

Kay, B.L.

1978: "*Mulch and Chemical Stabilizers for Land Reclamation in Dry Regions.*" Pages 467-483 In F.W. Schaller and P. Sutton (eds.). Reclamation of Drastically Disturbed Lands. American Society of Agronomy, Inc., Crop Science Society of America, Inc., Soil Science Society of America, Inc. 742 pp.

Kemp, Pamela and Bell, Beth

1991: Mesa Airlines, Verbal report on recent Mesa Airline passenger statistics to and from Campbell County Airport, November.

Lane, John

1991: State of Wyoming Department of Transportation, Written correspondence detailing Highway 59 traffic volumes and LOS values for current and estimated traffic increases from the proposed Rocky Butte Coal Mine.

Lundell, Jay

1991: Campbell County Airport, verbal report and written statistics on Campbell County Airport operations.

Mariah Associates, Inc.

1988a: Wildlife Monitoring and Raptor Nesting Research Report for the Seminoe 2 Mine, Carbon County, Wyoming December 1987 - November 1988. Prepared for Arch of Wyoming, Hanna, Wyoming, by Mariah Associates, Inc., Laramie, Wyoming. 22 pp. + append.

1988b: Wildlife Monitoring and Raptor Nesting Research Report for the Medicine Bow Mine, Carbon County, Wyoming. Prepared for Arch of Wyoming, Inc., Hanna, Wyoming by Mariah Associate, Inc., Laramie, Wyoming. 19 pp. + append.

1991: Class III Cultural Resource and Historic Survey of the Proposed Rocky Butte Permit Area, in preparation.

Markoff, D.S.

1981: Cultural Resource Inventory: A Historical Study of the North Antelope Coal Field, Campbell and Converse Counties, Wyoming. Prepared for North Antelope Coal Company by Western Cultural Resource Management, Inc., Boulder, Colorado.

Martner, Brooks E.

1986: *Wyoming Climate Atlas: In Cooperation with the Wyoming Water Research Center,* University of Wyoming.

McGraw Hill Incorporated

1990-1991: "Coal Week." Volume 17, November 16, 1990; April 22, 1991.

McIntosh, et al.

1984: "*Correlation and Effect of Mine Facility Wells on the Tullock Aquifer in the Gillette, Wyoming Vicinity.*" Report to OSM by G.E. McIntosh, C.A. Harrison, and J.O. Wilcox.

Merritt, F.S.

1976: "*Standard Handbook for Civil Engineers.*" 2nd Ed., McGraw-Hill Book Co., New York.

Monsen, S.B., and P. A. Plummer

1978: "*Plants and Treatment for Revegetation of Disturbed Sites in the Intermountain Area.*" Pages 155-173. In R.A. Wright (ed.) The Revegetation of Disturbed Arid Lands. University of New Mexico Press, Albuquerque, New Mexico. 196 pp.

Morgan, Racine

1991: Continental Express, verbal report on recent Continental Express operations and passenger statistics at the Campbell County Airport.

REFERENCES

Mulloy, W.T.

1958: *"A Preliminary Historical Outline for the Northwestern Plains."* Publications in Science 22(1). University of Wyoming, Laramie.

Natural Resources Research Institute

1966: *Wyoming Weather Facts*, College of Engineering, University of Wyoming, Laramie, Wyoming.

Oakleaf, B., B. Luce, S. Ritter, and A. Cerovski (eds.)

1991: Draft Distribution and Status of Wyoming Birds and Mammals. Wyoming Game and Fish Department. Cheyenne. 152 pp.

Office of Surface Mining

1980: Proposed Mining and Reclamation Plan, Rojo Caballo Mines, Campbell County, Wyoming. Final Environmental Impact Statement OSM-EIS-3.

1982: "Proposed Mining and Reclamation Plan, North Antelope Mine, Campbell County, Wyoming. Final Environmental Impact Statement, OSM-EIS-6.

1982: "Proposed Mining and Reclamation Plan, Antelope Mine, Converse County, Wyoming Final Environmental Impact Statement", OSM-EIS-5, Prepared by the U.S. Office of Surface Mining Reclamation and Enforcement, February.

1982: Proposed Mining and Reclamation Plan, North Rochelle Mine, Campbell County, Wyoming. Final Environmental Impact Statement OSM-EIS-9.

1988: "Proposed Mining Plan, Dry Fork Mine, Campbell County, Wyoming Final Environmental Impact Statement", OSMRE-EIS-24, Prepared by the U.S. Office of Surface Mining Reclamation and Enforcement, March.

Olendorff, R.R., A.D. Miller, and R.N. Lehman

1981: Suggested Practices for Raptor Protection on Power Lines; the State of the Art in 1981. Raptor Research Foundation, Inc., Hastings, Minnesota. 110 pp.

Packer, P.E., and E.F. Alden

1978: Revegetation Techniques for Dry Regions. Pages 425-450. In F.W. Schaller and P. Sutton (eds.). Reclamation of Drastically Disturbed Lands. American Society of Agronomy, Inc., Crop Science Society of America, Inc. Soil Science Society of America, Inc. 742 pp.

Persinger, R.E., R.A. Williams, M. Flanigan, and C. McKinney

1981: A Cultural Resource Inventory of the Texas Energy Services Rocky Butte Mine, Campbell County, Wyoming. Prepared for Environmental Research and Technology, Inc. Powers Elevation, Denver.

Phillips, R.L., and A.E. Beske

1990: Distribution and Abundance of Golden Eagles and Other Raptors in Campbell and Converse Counties, Wyoming. U.S. Department of the Interior, Fish and Wildlife Service, Fish and Wildlife Technical Report 27. Washington, D.C. 31 pp.

Proctor, B.R., R.W. Thompson, J.E. Bunin, K.W. Fucik, G.R. Tamm, and E.G. Wolf

1983: Practices for Protecting and Enhancing Fish and Wildlife on Coal Surface-Mined Land in the Powder River-Fort Union Region. U.S. Department of Interior, Fish and Wildlife Service FWS/OBS-83-10. 246 pp.

Reed, P.B., Jr.

1988: National List of Plant Species that Occur in Wetlands. Wyoming. U.S. Fish and Wildlife Service, St. Petersburg, Florida. 24 pp. + append.

Rosenberg, R.G.

1991: A Historical Synthesis of the Eastern Powder River Basin, Campbell and Converse Counties, Wyoming. Prepared for the Wyoming State Historic Preservation Office, by Rosenberg Historical Consultants, Cheyenne, Wyoming.

Shortley, G. and Williams, D.

1964: *"Elements of Physics, Volume II,"* 3rd Ed., G. Shortley and D. Williams.

Soil Conservation Service

1987: *"National Hydric Soils List and Criteria."* National Technical Committee for Hydric Soils.

1990: "Revision to Hydric Soils Criteria." National Bulletin No. 430-1-3. January 2, 1981.

1991a: "Soil Survey of Campbell County, Wyoming." Unpublished, in progress. Current mapping and soils information available at the SCS office in Gillette, Wyoming.

1991b: "Hydric Soils List, Campbell County, Wyoming, Southern Part (SS605)." April 10th, 1991.

REFERENCES

Southward, J.A., and P.D. Friedman

1981: A Cultural Resources Inventory of the Hampshire Energy Coal-to-Gasoline Plant Site. Prepared for Hampshire Energy. Science Applications, Inc., Boulder.

Stearns Catalytic Corporation

1984: *The Campbell County Monitoring Program-- 1984 Report.*

State of Wyoming

1970-1990: "State Inspector of Mines 1970-1990." Annual Reports of the State Inspector of Mines, Office of the State Inspector of Mines, Rock Springs, Wyoming.

1980: "Water Quality Rules and Regulations, Chapter VIII, Quality Standards for Wyoming Ground Waters." Wyoming Department of Environmental Quality, Water Quality Division, April 9th, 1980.

Tibesar, W.L., S. Scott, P.H. Sanders, and K.H. Dueholm

1983: Results of the 1983 Intensive Cultural Resource Inventory of the Carter Mining Company's Caballo Mine Expansion Areas. Prepared for Carter Mining Company, Gillette. Larson-Tibesar Associates, Laramie.

Urich, Adam

1991: State of Wyoming Department of Transportation, Verbal report of average daily 1990 traffic flows on State Highway 59 south from the I-90 intersection to mile 102.37, November.

U.S. Department of Commerce, Bureau of the Census

var.: 1967, 1972, 1977, 1981, 1984, 1989. Census of Agriculture, Volume 1-Geographic Area Series, Part 50, Wyoming State and County Data. U.S. Government Printing Office, Washington, D.C. 200 pp. + append.

1978: "*The Noise of Mobile Machines Used in Surface Coal Mines: Operator Exposure, Source Diagnosis, Potential Noise Control Treatments.*" Bolt Beranek and Newman, Inc., Cambridge, Massachusetts, August.

1990: "1990 Census." Department of Commerce/Bureau of the Census.

U.S. Department of Energy

1990: "Energy Information Administration, 1990." Coal Production 1982-1989 issues, DOE/EIS-0018(89) and previous issues.

U.S. Fish and Wildlife Service

1991: Raptor Nest Map. Unpublished.

U.S. Forest Service

1979: User Guide to Soils: Mining and Reclamation in the West. General Technical Report. INT-68. 80 pp.

1984: "*Reclaiming Disturbed Lands.*" Darrell Brown, Richard G. Hallman, Missoula, Montana, November.

1991: "Landscape Design Guidelines for Reclaimed Coal-Mine Land, Ecological and Visual Attributes of Biodiversity." Prepared for Thunder Basin National Grassland, Judy von Ahlefeldt, Douglas Ranger District, USFS, April.

U.S. Geological Survey

1961: "*Hydrology of the Upper Cheyenne River Basin, Part B, Sediment Sources and Drainage - Basin Characteristics in Upper Cheyenne River Basin.*" R.F. Hadley and S.A. Schumm, 1961. USGS Water-supply Paper 1531.

1978: "Proposed Mining and Reclamation Plan, Coal Creek Mine, Campbell County, Wyoming. Draft Environmental Statement, DES 78-35.

1986: "*Investigations of Possible Effects of Surface Coal Mining on Hydrology and Landscape Stability in Part of the Powder River Structural Basin, Northeastern Wyoming,*" by Bloyd, R.M., P.B. Daddow, P.R. Jordan, and H.W. Lowham. USGS Water Resources Investigations Report 86-4329.

1988: "*Cumulative Potential Hydrologic Impacts of Surface Coal Mining in the Eastern Powder River Structural Basin - Northeastern Wyoming,*" by Lawrence J. Martin, David L. Naftz, H.W. Lowham, and R.G. Rankl, U.S. Geological Survey, Water Resources Investigations Report 88-4046. Prepared in cooperation with Wyoming Department of Environmental Quality and U.S. Office of Surface Mining, Cheyenne, Wyoming.

1991: "Evaluation of Ground-Water Level Changes near Gillette, Northeastern Wyoming," by Marvin A. Crist. Water-Resources Investigations Report 88-4196. In cooperation with the Wyoming State Engineer.

REFERENCES

U.S. Soil Conservation Service

1982: Plant Materials for Use on Surface-Mined Lands in Arid and Semiarid Regions. USDA Soil Conservation Service, SCS-TP-157. 88 pp.

1988: *"Plant Materials Handbook."* Soil Conservation Service and Office of Surface Mining Reclamation and Enforcement, May 1988.

University of Wyoming

1974: *"Characteristics of Wyoming Stock-Water Ponds and Dike Spreader Systems."* Smith, Verne E., July. Water-Resources Series No. 47.

Western Water Consultants, Inc.

1983a: *"Determination of Cumulative Hydrologic Impacts in the Fort Union Formation in the Vicinity of the Eagle Butte Mine."* Prepared for Amax Coal Company.

1983b: *"Determination of Cumulative Hydrologic Impacts for the Fort Union Formation in the Vicinity of the Proposed Dry Fork Mine."* Prepared for Phillips Coal Company.

Wyoming Agricultural Statistics Service

1991: Wyoming Agricultural Statistics 1991. Wyoming Department of Agriculture, the University of Wyoming, and the USDA National Agricultural Statistics Service. 92 pp.

Wyoming Department of Administration and Fiscal Control

1988: Division of Research and Statistics, *Wyoming Population and Employment Forecast Report.*

Wyoming Department of Administration and Information

1991a: Division of Economic Analysis, Wyoming State Data Center Bulletin, Volume II, Number 3.

1991b: Division of Economic Analysis, *Wyoming Income and Employment.*

var.: Division of Economic Analysis, Biannual Wyoming Cost of Living Reports, December 1988, September 1989, December 1989, June 1990, December 1990, and June 1991c.

1991d: Division of Economic Analysis, Wyoming Sales and Use Tax Revenue Report.

Wyoming Department of Education

var.: Statistical Report Series No. 2--School District Fall Report of Staff, Teachers/Pupils/Schools, and Enrollments.

1990b: Statistical Report Series No. 3--Wyoming Public Schools Fund Accounting Report.

Wyoming Department of Employment

1989: Division of Research and Planning, *State and County Summary of Covered Employment and Total Payrolls by Industry - Second Quarter, 1989.*

1991a: Division of Research and Planning, *Wyoming Labor Force Trends,* Volume 28, Number 7.

1991b: Division of Research and Planning, *1989-1990 Annual Covered Employment for the State of Wyoming.*

Wyoming Department of Environmental Quality

1980: Water Quality Rules and Regulations, Chapter VIII, *Quality Standards for Groundwaters of Wyoming, Water Quality Division.*

1981: Alluvial Valley Floors. Guideline No. 9. Cheyenne. 21 pp., Land Quality Division.

1984: Topsoil and Overburden. WDEQ/LQD Guideline No. 1.

1986: Vegetation Sampling Methods and Reclamation Success Standards for Surface Coal Mining Operations. WDEQ/LQD Rules and Regulations, Appendix A.

1987: Guideline No. 5, Wildlife. Wyoming Department of Environmental Quality, Land Quality Division. 19 pp.

1989: Coal Rules and Regulations. 233 pp. Wyoming Department of Environmental Quality, Land Quality Division.

1989: Wyoming Air Quality Standards and Regulations. 88 pp. Wyoming Department of Environmental Quality, Air Quality Division.

Wyoming Department of Revenue and Taxation

var.: Annual Reports.

Wyoming Game and Fish Department

1991a: South Gillette (Mimeographed List of Ranchers with Past History of Accommodating Hunters in the Area). 3 pp.

1991b: Annual Big Game Herd Unit Reports, 1990. Wyoming Game and Fish Department, Cheyenne. Vol. 15.

1991c: Wildlife Observation System List for Raptors, Upland Game Birds, and Big Game Animals. Wyoming Game and Fish Department, Cheyenne. Printout. 97 pp.

REFERENCES

1991d: Campbell County. 1991. Wildlife and Natural History Loop Tours. Wyoming Game and Fish Department et al. 15 pp.

n.d.: Master Legend for Wildlife Distribution Overlays. Mimeograph. 2 pp.

Wyoming Coal Information Committee

1991: "A Concise Guide to Wyoming Coal." Wyoming Coal Information Committee, Gillette, Wyoming.

Wyoming State Board of Control

1963: Tabulation of Adjudicated Water Rights of the State of Wyoming, Water Division No. 2, with periodic supplements.

Zilly, R.G.

1975: "*Handbook of Environmental Civil Engineering.*" Van Nostrand Reinhold Co., ed by R. Zilly.

APPENDIX A

VALIDATION OF UNSUITABILITY CRITERIA FOR WEST ROCKY BUTTE TRACT

Table A-1. Validation of Unsuitability Criteria for West Rocky Butte Tract

UNSUITABILITY CRITERIA	FINDINGS FROM BUFFALO RESOURCE AREA RMP (BLM, 1985)	VALIDATION FOR WEST ROCKY BUTTE TRACT
1. Federal Land Systems. With certain exceptions that do not apply to this tract, all federal lands included in the following systems are unsuitable for leasing: National Parks, National Wildlife Refuges, National System of Trails, National Wilderness Preservation System, National Forests and federal lands in incorporated cities, towns and villages.	None of the listed federal lands categories are present within the Buffalo Resource Area coal development review area.	Not applicable to West Rocky Butte.
2. Rights of Way and Easements. Federal lands that are within rights of way or easements or within surface leases for residential, commercial, industrial or other public purposes, or for agricultural crop production on federally owned surface are unsuitable for leasing.	Rights of way and buffers for mainline railroads, I-25 and I-90 were declared unsuitable.	None of these rights of way are on the WRB tract, and the area is available for further consideration.
3. Buffer Zones for Rights of Way, Communities, and Buildings. Federal lands within 100 feet of a right of way of a public building, school, church, community or institutional building or public park or within 300 feet of an occupied dwelling.	Within the study area there were 390 acres around dwellings that were considered unsuitable.	None of the occupied dwellings are within 300 feet of the tract, and the tract is therefore available for further consideration.
4. Wilderness Study Areas. Federal lands designated as wilderness study areas are unsuitable while under review for possible wilderness designation.	A portion of the Fortification Creek wilderness study area is within the review area but not near the WRB tract.	There are no unsuitable findings, and the WRB tract is available for further consideration.
5. Scenic Areas. Scenic federal lands designated by visual resource management analysis as Class I (outstanding visual quality or high visual sensitivity) but not currently on National Register of Natural Landmarks are unsuitable.	No lands on the review area meet the scenic criteria as outlined.	There are no unsuitable findings, and the WRB tract is available for further consideration.
6. Land Used for Scientific Study. Federal lands under permit by the surface management agency and being used for scientific studies involving food or fiber production, natural resources, or technology demonstrations and experiments are unsuitable for the duration of the study except where mining would not jeopardize the purpose of the study.	No lands in the review area are under permit except small enclosures being used to gage reclamation success on existing mines.	There are no unsuitable findings, and the WRB tract is available for further consideration.
7. Historic Lands and Sites. All districts, sites, buildings, structures, and objects of historic, architectural, archeological, or cultural significance on federal lands included in or eligible for inclusion in the National Register of Historic Places and an appropriate buffer zone are unsuitable.	On the basis of the consultation with the State Historic Preservation Office, there were no unsuitable findings under this criterion in the review area. No sites in the review area are listed on the National Register for Historic places.	There are no unsuitable findings, and the WRB tract is available for further consideration.
8. Natural Areas. Federal lands designated as natural areas or National Natural Landmarks are unsuitable.	The Dry Creek Petrified Tree Natural Area was identified as unsuitable. This is not on or near the WRB tract.	There are no unsuitable findings, and the WRB tract is available for further consideration.
9. Critical Habitat for Threatened or Endangered Plant and Animal Species. Federally designated critical habitat for T & E plant and animal species, and essential habitat for T & E species are unsuitable.	There is no federally designated critical habitat for T & E plant or animal species within the review area. Prairie dog towns were considered acceptable pending further study.	There are no unsuitable findings, and the WRB tract is available for further consideration.

Table A-1. Validation of Unsuitability Criteria for West Rocky Butte Tract (continued)

UNSUITABILITY CRITERIA	FINDINGS FROM BUFFALO RESOURCE AREA RMP (BLM, 1985)	VALIDATION FOR WEST ROCKY BUTTE TRACT
10. State Listed Species. Federal lands containing habitat determined to be critical or essential for plant or animal species listed by a state pursuant to state law as T & E shall be considered unsuitable.	Wyoming does not maintain a state list of T & E species of plants or animals. Therefore, this criterion does not apply.	There are no unsuitable findings, and the WRB tract is available for further consideration.
11. Bald or Golden Eagle Nests. An active bald or golden eagle nest and appropriate buffer zone are unsuitable unless the lease can be conditioned so eagles will not be disturbed during breeding season or unless golden eagle nests will be moved.	The BLM found numerous eagle nests, and buffer zones were established, and determined that about 116,000 acres are unsuitable under this criterion.	No active eagle nests were found on or near the WRB tract. There are no unsuitable findings, and the WRB tract is available for further consideration.
12. Bald and Golden Eagle Roost and Concentration Areas. Bald and golden eagle roost and concentration areas on federal lands during migration and wintering are unsuitable unless mining can be conducted in such a way as to ensure that eagles shall not be disturbed.	No golden eagle roost or concentration areas occur on the review area. Bald eagle roosts and buffer areas encompassing about 980 acres were declared unsuitable.	None of the bald eagle roosts are on the WRB tract, and the WRB tract is available for further consideration.
13. Federal lands containing an active falcon (excluding kestrel) cliff nesting sites and a suitable buffer zone shall be considered unsuitable.	About 5,700 acres were determined unsuitable because of prairie falcon nests and buffer areas.	None of the sites are on the WRB tract, and the WRB tract is available for further consideration.
14. Habitat for Migratory Bird Species. Federal lands which are high priority habitat for migratory bird species of high federal interest shall be considered unsuitable.	About 460 acres were declared unsuitable due to two active merlin nests.	Neither of the sites is on the WRB tract, and the WRB tract is available for further consideration.
15. Fish and Wildlife Habitat for Resident Species. Federal lands which the surface management agency and state jointly agree are fish and wildlife habitat of resident species of high interest to the state, and which are essential for maintaining these priority wildlife species, shall be considered unsuitable.	About 13,300 acres were declared unsuitable under this criterion.	None of the unsuitable areas are on the WRB tract, and the WRB tract are available for further consideration.
16. Floodplains. Federal lands in riverine, coastal, and special floodplains shall be considered unsuitable unless stipulated methods of mining can be undertaken without substantial threat of loss of life or property.	After consultation with the USGS, it was determined that floodplains can be mined with site specific stipulations and resource protection safeguards to be developed during mining and reclamation planning. Therefore, all lands within the review area are available for further consideration.	There are no unsuitable findings, and the WRB tract is available for further consideration.
17. Municipal Watersheds. Federal lands which have been committed by the surface management agency to use as municipal watersheds shall be considered unsuitable.	There are no municipal watersheds in the review area.	There are no unsuitable findings, and the WRB tract is available for further consideration.
18. National Resource Waters. Federal lands with national resource waters, as identified by states in their Water Quality Management Plans, and 1/4-mile buffer zones shall be unsuitable.	There are no natural resource waters within the review area.	There are no unsuitable findings, and the WRB tract is available for further consideration.

Table A-1. Validation of Unsuitability Criteria for West Rocky Butte Tract (continued)

UNSUITABILITY CRITERIA	FINDINGS FROM BUFFALO RESOURCE AREA RMP (BLM, 1985)	VALIDATION FOR WEST ROCKY BUTTE TRACT
19. Alluvial Valley Floors. All lands identified by the surface management agency, in consultation with the state, as AVFs where mining would interrupt, discontinue or prelude farming, are unsuitable. Additionally, when mining federal lands outside an AVF would materially damage the quality or quantity of water in surface or underground water systems that would supply AVFs, the land shall be considered unsuitable.	Lands along prominent drainages were considered potential AVFs pending a final determination by the state. These lands are placed in an "available pending further study" category and are not considered unsuitable.	Tisdale Creek was included in the potential AVFs. Tisdale Creek is being mined and reclaimed downstream, and it is considered available for further consideration pending a determination during mine permitting.
20. State or Indian Tribe Criteria. Federal lands to which is applicable a criterion proposed by the state or Indian tribe located in the planning area and adopted by rulemaking by the Secretary are unsuitable.	The state has no applicable criteria and there is no Indian tribe located in or near the planning area. Therefore there is no unsuitability finding.	Various tribal entities were notified during scoping process. None expressed concerns. Thus the WRB tract is available for further consideration.

APPENDIX B

RECLAMATION PLAN

APPENDIX B. RECLAMATION PLAN

Introduction

This section describes the lease applicant's proposed reclamation plan for the Rocky Butte Mine. This plan would be implemented as a part of the activities that would take place under the Proposed Action. The reclamation plan, as with the mining plan, has not yet been approved by the Wyoming DEQ and OSM and therefore may be subject to change during the mine permitting process.

The goal of reclamation at the Rocky Butte Mine would be to establish a diverse and sustainable ecological system that is compatible with proposed postmining land uses and with adjacent lands. Erosion control, establishment of self-regenerating native plant communities and productive hay and croplands, restoration of wildlife habitat, and conformance with landowner requests would be the principal objectives of reclamation. To assist in reaching these objectives, reclamation activities would be initiated as soon as practical after an area is mined. Final reclamation would be required to meet state reclamation success standards.

This plan describes postmining land use objectives and presents generalized reclamation procedures that would be used at the Rocky Butte Mine. The scope of this plan includes topsoil storage and replacement, short and long term erosion control, seedbed preparation, seed mixtures and seeding methods, post-seeding maintenance, and development of diverse wildlife habitat.

Postmining Land Use

The proposed postmining land use would be similar to premining and historic uses of land within and adjacent to the Rocky Butte project area (Table 3-10). Cropland, grazingland, pastureland, and wildlife habitat would be the principal postmining land uses.

Three native and two tame vegetation types would be established during reclamation. The combined area occupied by the big sagebrush, silver sagebrush, and saline big sagebrush types (2,154 acres of the proposed disturbed area) would be reclaimed as sagebrush shrubland. Upland grass and lowland grass types would be restored to the approximate acreages existing prior to mining. Acreage occupied by pasture would be converted to haylands. Approximately 3,752 acres of land would be restored to cropland capable of producing hay and small grain crops.

Recreational land use, which is primarily big game hunting, would be restored with restoration of wildlife habitat. Stockponds and reservoirs would be constructed throughout the project area during reclamation. The distribution and dimensions of these water sources would be designed to maximize potential use by livestock and wildlife and to meet the requirements of landowners.

Occupants of residences within the proposed affected area have agreed to move permanently. Thus, there are no plans to reestablish a residential land use. None of the premining industrial-commercial/lands or transportation systems would be reestablished during reclamation.

Reclamation Plan

Surface Preparation

Prior to construction and mining of each mine unit, all topsoil suitable for plant growth would be stripped to a maximum depth of 60 inches and either stockpiled for later use during reclamation or backhauled directly to areas prepared for reclamation. If topsoil is to be stockpiled for more than six months, a temporary cover of grasses and forbs would be established on stockpiles to minimize erosion.

After mining pits are backfilled, surfaces would be graded and smoothed to conform, as much as possible, with the surrounding landscape. Final slopes would be 5:1 (horizontal:vertical) or less. Headwalls would be benched and terraced to reduce erosion potential and promote establishment of vegetation. Graded slopes would be ripped to

roughen surfaces and promote cohesion between topsoil and subsurfaces.

Topsoil spreading and seedbed preparation would be completed before April 15 or after October 1 prior to the ground freezing (Parker and Alden, 1978). Topsoil would be spread evenly over prepared surfaces. The minimum depth of topsoil replacement would be 18 inches. Seedbeds would be disked to scarify soils and to incorporate soil amendments, if needed. Tillage and seeding operations would be conducted along contour wherever possible.

Topsoil would be analyzed for nutrient content and potential toxicity to determine the need for soil amendments. Toxic or otherwise unsuitable soils would be buried below the rooting zone and above the water table. If soil analyses indicate the need for amendments such as fertilizer or lime, additions would be incorporated into soils during seedbed preparation.

Seed Mixtures and Seeding Methods

Three permanent native seed mixtures, two permanent tame mixtures, and three temporary mixtures would be used to revegetate affected areas (Table B-1). Species included in the native seed mixtures were selected to provide erosion control, forage for livestock and wildlife, and wildlife habitat and to promote vegetative diversity and sustainability. The species are well adapted to the climate and the variety of soil characteristics that are encountered in the project area (Cook et al., 1974, and SCS, 1982, 1988).

Permanent Seed Mixtures and Seeding Methods

Erosion control and soil and water conservation are primary considerations in reclamation planning in the region (Cook et al., 1974, and Monsen and Plummer, 1977). After seedbed preparation, a preparatory crop of an annual grain (Table B-1) would be planted to assist in mitigating both of these problems. The preparatory crop would be planted before April 15 or after October 1 before the ground freezes, depending on when seedbed preparation is completed and the type of crop planted. Seeding would take place within 14 days after topsoil is spread to reduce soil losses due to wind and/or water erosion. If it becomes impossible to plant seeds within 14 days, exposed soil surfaces would be roughened to reduce erosion.

The preparatory crop would be mowed at the end of the first growing season, prior to seedhead development. Stubble and mulch would be left in place to prevent erosion, reduce soil moisture loss due to evaporation, and to reduce soil compaction due to raindrop impact. An additional benefit of using a cover crop is the input of organic matter into soils from the decaying roots of annuals (Barbour et al., 1980).

Because postmining topography and drainage control the distribution of runoff, snow capture, and therefore soil moisture, characteristics of the postmining landscape would be used to determine where each permanent seed mixture should be applied. Hayland and cropland would be established on gently sloping surfaces that are easily accessible with farming equipment. Tame mixtures would be planted, maintained, and harvested using conventional farming techniques.

The upland and lowland grass mixtures include a variety of grasses (cool season, warm season, sod-forming and bunch grasses) which would stabilize soils and provide substantial forage for livestock and wildlife. Several forbs and shrubs would be included to provide important quality forage for wildlife and improve the visual quality of reclaimed areas. Shrubs also provide additional erosion control and snow catchment. Legumes would be included as forage species and to enhance nitrogen availability in soils.

The upland grass mixture would be applied to approximately 835 acres of the reclaimed area. This mixture would be used to revegetate drier sites, including but not limited to hilltops, ridges, and/or upland and south-facing slopes. The lowland grass mixture would be applied to approximately 124 acres. This mixture would be used to revegetate banks of channels, stockponds, reservoirs, and other areas with high potential for elevated soil moisture.

Table B-1. Comparison of Premining and Proposed Postmining Acreage of Vegetation Types, Rocky Butte Mine

Vegetation Type	Approximate Acreage Affected	Percent of Project Area	Vegetation Type	Approximate Acreage to be Restored	Percent of Project Area
Big Sagebrush	1,066	11	Sage Shrubland	2,154	22
Silver Sagebrush	789	8			
Saline Big Sagebrush	299	3			
Upland grass	835	9	Upland grass	835	9
Lowland grass	124	1	Lowland grass	124	1
Cropland	3,752	39	Cropland	n.a.[1]	n.a.
Pasture	327	3	Pasture	327	3
Riparian	52	1	Riparian	52	1
Disturbed	89	1	Disturbed	0[2]	0
Total Affected Acreage	7,333		Total Reclaimed Acreage	7,333	

[1] 3752 acres would be restored to a condition capable of supporting cropland. During the life-of-mine, these areas would be planted to upland grass, lowland grass, pasture, crops and/or a temporary plant cover.

[2] The 89 acres of disturbed land would be reclaimed with the seed mixtures used to reclaim surrounding areas.

There has been marginal to good success establishing shrubs on reclaimed areas at other coal mines in the Eastern Powder River Basin (personal communication, October 11, 1991, with Paige Smith, WDEQ/LQD, Cheyenne; October 16, 1991, with Scott Rexcoat, Carter Mining Co., Gillette). Because shrub seedlings are less drought tolerant and develop more slowly than many grasses and forbs, competition for water often prevents good shrub establishment (Monsen and Plummer, 1977). Shrub-dominated communities would be created using shrub mosaic mixtures. Establishment of shrubs included in the upland and lowland grass mixtures would improve the overall distribution of shrubs in the project area.

The shrub mosaic mixture would be applied in areas where there is good potential for the higher soil moisture required for shrub establishment. These areas would include the banks of ephemeral drainages, swales, toeslopes, north-facing slopes, or other areas where water and/or snow may accumulate.

Approximately 2,154 acres of the reclaimed area would be seeded with the shrub mosaic mixture. To enhance the quality of wildlife habitat of reclaimed areas, the mixture would be planted in patches that conform with the anticipated rolling topography, rather than in trapezoidal patches. Final shrub density within patches would be one shrub per square meter.

Permanent native seed mixtures would be planted directly into the preparatory crop stubble in the spring (before April 15) or fall (after October 1 but before the ground is frozen) of the year following crop growth (Parker and Alden, 1978). Seeds,

except winterfat, would be planted 0.25 to 0.5 inch deep with a rangeland or similar drill equipped with an agitator and two seed boxes to ensure uniform distribution of seeds. Because winterfat seed is too fluffy to drill, it would be broadcast prior to drill-seeding other species.

Table B-2. Seed Mixtures for Permanent and Temporary Reclamation, Rocky Butte Mine

	Permanent[1]					Temporary[2]		
	Upland Grass	Lowland Grass	Shrub Mosaic	Pasture	Cropland	Upland Grass[3]	Lowland Grass[4]	Preparatory Crop
Agropyron smithii	4.00	3.00	1.50			8.00	6.00	
Agropyron dasystachyum	2.00	1.00	0.50			6.00		
Agropyron riparium		3.00	1.00				6.00	
Bouteloua gracilis	2.00	2.00	1.00					
Poa sandbergii	3.00	2.00	1.00			4.00		
Sporobolus airoides		1.00	0.50				4.00	
Stipa viridula		3.00						
Spartina pectinata		1.00	0.50					
Elymus cinereus		1.00	0.50				2.00	
Calamovilfa longifolia	2.00					2.00		
Achillea millifolium	0.50							
Psoralea argophylla	0.50	0.50	0.25					
Sphaeralcea coccinea	1.00	1.00	0.50					
Onobrychis viciaefolia	.50	.50						
Thermopsis spp.	0.25	0.25	0.25					
Pentstemon spp.	0.25	0.25	0.25					
Artemisia cana	0.25	0.25	4.00					
Artemisia tridentata wyomingensis	0.25	0.25	4.00					
Artemisia frigida	0.25	0.25	1.00					
Krascheninnikovia lanata	1.00[5]	1.00[5]	2.00[5]					
Chrysathamnus nauseosis			1.00[5]					
Atriplex canescens	0.50	0.50	0.25					
Rosa woodsii	0.25	0.25	0.25					
Ribes cereum			0.25					
Agropyron cristatum				10.00				
Medicago sativa				1.00		0.50	0.50	
Triticum spp.					30.00[6]			12.00[7]
Avena spp.					30.00[6]			12.00[7]
Hordeum spp.					30.00[6]			12.00[7]
TOTAL PLS/ACRE	19.50	21.00	20.75	11.00	30.00	20.50	18.50	12.00

[1] Pounds Pure Live Seed (PLS) drilled per acre.
[2] Pounds PLS broadcast per acre.
[3] To be used on stockpiles, around facilities, and along rights-of-way.
[4] To be used around sediment ponds and stream diversions or ditches.
[5] Broadcast seed prior to drill seeding other species.
[6] One of these grains or other appropriate crops would be planted as a cash crop.
[7] One of these grains would be planted as a preparatory crop.

If the terrain to be revegetated is unsuitable for drill-seeding, no annual crop would be planted, and a temporary or permanent mixture would be planted immediately following seedbed preparation. Seeding rates would be doubled and seeds would be broadcast and surfaces raked with a chain or harrow to cover seed. Areas that have been broadcast seeded would be mulched with two tons per acre straw or hay mulch to reduce erosion and soil moisture loss due to evaporation (Kay, 1978). Mulch would be anchored by crimping. It would be free of mold, undesirable weed seeds, and insects.

Drill-seeding, broadcast-seeding and hydroseeding each may be an effective technique for planting the shrub mosaic mixture (personal communication, October 16, 1991, with Scott Rexcoat, Carter Mining Company). Success rates obtained using each of these planting techniques would be evaluated as reclamation progresses, and shrub establishment procedures would be modified as necessary.

Temporary Seed Mixtures and Seeding Methods

Temporary seed mixtures would be used to stabilize soils in certain areas. The upland grass temporary mixture will be used on the grounds of administrative facilities, slopes along the grade for the railroad spur, topsoil stockpiles, haul road rights-of-way, the Four Corners Road relocation, and any other upland areas requiring immediate stabilization. The lowland grass temporary mixture would be used to stabilize areas such as the banks of disturbed channels, ditches, sediment ponds, and dewatering facilities.

Temporary mixtures would be broadcast over the areas to be stabilized as soon as construction or mining activities permit. The surface would then be raked with a chain or harrow to cover seeds. If the temporary cover should fail to stabilize soils, mitigation measures such as reseeding and/or application of mulches, netting, or other erosion control devices would be applied so that soil loss is minimized. At the close of mining, or as mining activities allow, areas seeded with temporary mixtures would be reclaimed with permanent vegetation.

Trees

Several species of trees would be established around selected stockponds and reservoirs. Root-stock or containerized saplings of peachleaf willow *(salix amygdaloides)*, plains cottonwood *(populus deltoides)*, green ash *(fraxinus pennsylvanicus)*, and box elder *(acer negundo)* would be planted around water resources to develop windbreaks for livestock and wildlife. If feasible, larger trees may be transplanted to developed ponds to provide immediate shelter and habitat for local fauna. Approximately 688 trees (Section 3.4) would be planted at densities ranging from three to 20 individuals per acre.

Post-Seeding Maintenance

Fences would be constructed around newly seeded areas to prevent damage by cattle and vehicular use. Fences may be constructed around tree saplings until they are mature enough to withstand the presence of livestock. Signs would be posted to discourage incidental trespass by humans. Reclamation success would be evaluated according to WDEQ/LQD rules and regulations. State laws require reclamation efforts to be repeated if standards are not met.

Wildlife Habitat Diversity

Establishment of grasses, forbs, shrubs, and trees would provide forage, browse, and shelter for wildlife. Essential structural elements of wildlife habitat would be created during reclamation by providing diversity in the landscape itself (i.e., lowlands, uplands, shrublands, ponds, drainages, and rockpiles). This diversity of landscape and vegetation would promote the reestablishment of wildlife species and numbers found in the premining project area. Establishment of a landscape/vegetation mosaic similar to premining patterns also creates habitat edges important for many species. Construction of stockponds and reservoirs would create key habitat for waterfowl and provide a primary resource for many other animals inhabiting the project area. Carefully situated rockpiles would provide cover and resting, denning, and nesting sites for numerous wildlife species. One rockpile would be established per 100 acres of reclaimed land.

Raptor nests occurring within the areas scheduled for disturbance would be moved to appropriate locations outside the project area. In some instances artificial nest structures may be used. Trees planted during reclamation should reach heights suitable for raptor nesting in 10 to 20 years.

LITERATURE CITED

Barbour, M.G., J.H. Burk, and W.D. Pitts. 1980. Terrestrial plant ecology. Benjamin/Cummings Publ. Co., Inc. Menlo Park, California. 60 pp.

Cook, C.W., R.M. Hyde, and P.L. Sims. 1974. Revegetation guidelines for surface mined areas. Colorado State University Range Science Series No. 16, Ft. Collins. 73 pp.

Kay, B.L. 1978. Mulch and chemical stabilizers for land reclamation in dry regions. Pages 467-483 In F.W. Schaller and P. Sutton (eds.). Reclamation of drastically disturbed lands. American Society of Agronomy, Inc., Crop Science Society of America, Inc., Soil Science Society of America, Inc. 742 pp.

Monsen, S.B., and P. A. Plummer. 1978. Plants and treatment for revegetation of disturbed sites in the intermountain area. Pages 155-173. In R.A. Wright (ed.) The revegetation of disturbed arid lands. University of New Mexico Press, Albuquerque, New Mexico. 196 pp.

Packer, P.E., and E.F. Alden. 1978. Revegetation techniques for dry regions. Pages 425-450. In F.W. Schaller and P. Sutton (eds.). Reclamation of drastically disturbed lands. American Society of Agronomy, Inc., Crop Science Society of America, Inc. Soil Science Society of America, Inc. 742 pp.

U.S. Forest Service. 1979. User guide to soils: mining and reclamation in the west. General technical report. INT-68. 80 pp.

U.S. Soil Conservation Service. 1982. Plant materials for use on surface-mined lands in arid and semiarid regions. USDA Soil Conservation Service, SCS-TP-157. 88 pp.

U.S. Soil Conservation Service. 1988. Plant materials handbook. Soil Conservation Service and Office of Surface Mining Reclamation and Enforcement, May 1988.

Wyoming Department of Environmental Quality, Land Quality Division. 1984. Topsoil and Overburden. WDEQ/LQD Guideline No. 1.

Wyoming Department of Environmental Quality, Land Quality Division. 1986. Vegetation sampling methods and reclamation success standards for surface coal mining operations. WDEQ/LQD Rules and Regulation, Appendix A.

APPENDIX C

VISUAL RESOURCE MANAGEMENT EVALUATION

APPENDIX C. VISUAL RESOURCE MANAGEMENT EVALUATION

The Visual Resource Management (VRM) evaluation was based on techniques used by the BLM (1980). It is an analytical process that identifies, sets, and meets objectives for the maintenance of scenic values and visual quality, and is based on research designed to objectively assess aesthetic qualities of the landscape. The technique is used in various situations, including environmental assessments.

The VRM classification ratings range from I to V as follows:

Class I - Natural ecologic changes and very limited management activity is allowed. Any contracts (activity) within this class must not attract attention.

Class II - Changes in any of the basic elements (form, line, color, texture) caused by an activity should not be evident in the landscape.

Class III - Contrasts to the basic elements caused by an activity are evident but should remain subordinate to the existing landscape.

Class IV - Activity attracts attention and is a dominant feature of the landscape in terms of scale.

Class V - This classification is applied to areas where the natural character of the landscape has been disturbed to a point where rehabilitation is needed to bring it up to the level of one of the other four classifications.

The inventory/evaluation process consists of three steps: 1) assessment of the landscape's scenic quality; 2) estimating the sensitivity of the people to change; and 3) determining the viewing distance. Scenic quality is evaluated by giving a numerical rating to each of seven factors, with higher ratings indicating higher quality visual resources (Table C-1). A summation of the seven numerical ratings determines scenic quality. In the case of the Rocky Butte Mine area, the total score of 6 places it in the Class C scenic quality category, which means it is an area with features common to the physiographic region.

Sensitivity levels are determined by combining two factors--user attitude and use volume. User attitude reflects the concerns the public expresses about proposed changes in scenic quality. Use volume reflects the frequency of travel through the area. For the proposed Rocky Butte Mine area, user attitude was rated LOW and use volume HIGH (Table C-2), resulting in an overall value of MEDIUM.

The viewing distance is divided into foreground-middleground (zero to five miles), background (five to 15 miles), and seldom seen (more than 15 miles or infrequently observed). For the Rocky Butte area the foreground/middleground was most involved.

By combining the sensitivity level (MODERATE), the scenic quality (C), and the viewing distance (foreground/middleground), the WRB area is classified as Management Class IV (BLM, 1980:24).

Literature Cited

United States Department of the Interior, Bureau of Land Management. 1980. Visual resource management program. U.S. Govt. Print. Off., Washington, D.C. 39 p.

APPENDIX C. VISUAL RESOURCE MANAGEMENT EVALUATION

Table C-1. Scenic Quality Inventory/Evaluation Ratings and Scores for the Proposed Rocky Butte Mine Area, Campbell County, Wyoming

	Factor						
	Landform	Vegetation	Water	Color	Adjacent Scenery	Scarcity	Cultural Modification
Possible Scores*	1,3,5	1,3,5	0,3,5	1,3,5	0,3,5	1,2,6	-4,0,2
Rocky Butte Score	3	1	0	1	0	1	0

* Higher scores indicate better scenic values.

Table C-2. Sensitivity Level Ratings and Scores for Proposed West Rocky Butte Mine Area, Campbell County, Wyoming

	Factor	
	User Attitude	Use Volume
Possible Scores	Low, Medium, High	Low, Medium, High
Rocky Butte Score	Low	High

APPENDIX D

MITIGATION

APPENDIX D. MITIGATION

This appendix describes measures and techniques that lessen or eliminate impacts. In considering mitigation one must be aware of the complex legal framework that governs the mining process from land use planning to leasing, acquisition of permits, and finally actual mining and reclamation.

The Buffalo Area RMP (BLM, 1985) states that the following general types of mitigating measures will be complied with in the development of federal coal lands:

- **Cultural Resources:** Field inventories and procedures for protection of cultural resources
- **Paleontological Resources:** Survey and resource recovery
- **Existing Rights:** Negotiation procedures
- **Soils:** Separation of "B" horizon material from underlying material
- **Survey Markers:** Protection from damage; provision for replacement
- **Raptors:** Buffer zones around nesting areas and restrictions as necessary on surface mining
- **Black-Footed Ferret Habitat:** Monitoring and inventory in accordance with prescribed guidelines
- **Migratory Birds of High Federal Interest:** Habitat recovery and replacement
- **Buffer Zones and Rights-of-Way:** Buffer zones unsuitable for surface mining for existing public facilities
- **Alluvial Valley Floors:** Mitigation or designation of unsuitability pending final determinations by authorized agencies

Mitigation can be applied as standard and special lease stipulations, conditions on mining permits and other regulatory permits, or as revisions to the mining and reclamation plan during the permit review process. The need for and the types of mitigation applied through lease stipulations and permit conditions have changed over the past decade as experience has been gained in mining and reclamation in the Powder River Basin. The special lease stipulations that BLM would impose on the West Rocky Butte lease tract would include the following:

In addition to observing the general obligations and standards of performance set out in the current regulations, the lessee shall comply with and be bound by the following stipulations. These stipulations are also imposed upon the lessee's agents and employees. The failure or refusal of any of these persons to comply with these stipulations shall be deemed a failure of the lessee to comply with the terms of the lease. The lessee shall require his agents, contractors and subcontractors involved in activities concerning this lease to include these stipulations in the contracts between and among them. These stipulations may be revised or amended, in writing, by the mutual consent of the lessor and the lessee at any time to adjust to changed conditions or to correct an oversight.

- **CULTURAL RESOURCES**

(1) Before undertaking any activities that may disturb the surface of the leased lands, the lessee shall conduct a cultural resource intensive field inventory in a manner specified by the authorized office of the BLM or of the surfacing managing agency, if different, on portions of the mine plan area and adjacent areas, or exploration plan area, that may be adversely affected by lease-related activities and which were not previously inventoried at such a level of intensity. The inventory shall be conducted by a qualified professional cultural resource specialist (i.e., archeologist, historian, historical architect, as appropriate), approved by the authorized officer of the surface managing agency (BLM, if the surface is privately owned), and a report of the inventory and recommendations for protecting any cultural resources identified shall be submitted to the Assistant Director of the Western Support Center of the Office of Surface Mining, the authorized officer of the BLM, if activities are associated with the coal exploration outside an approved mining permit area (hereinafter call Authorized Officer), and the Authorized Officer of the surface managing agency, if different. The lessee shall undertake measures, in accordance with instructions from the Assistant Director or Authorized Officer to protect cultural resources on the lease lands. The lessee shall not commence the surface disturbing activities until permission to proceed is given by the Assistant Director or Authorized Officer.

(2) The lessee shall protect all cultural resource properties within the lease area from lease-related activities until the cultural resource mitigation measures can be implemented as part of an approved mining and reclamation plan or exploration plan.

(3) The cost of conducting the inventory, preparing reports, and carrying out mitigation measures shall be borne by the lessee.

(4) If cultural resources are discovered during operations under this lease, the lessee shall immediately bring them to the attention of the Assistant Director or Authorized Officer, or the Authorized Officer of the surface managing agency. The lessee shall not disturb such resources except as may be subsequently authorized by the Assistant Director or Authorized Officer. Within two (2) working days of notification, the Assistant Director or Authorized Officer will evaluate or have evaluated any cultural resources discovered and will determine if any action may be required to protect or preserve such discoveries. The cost of data recovery for cultural resources discovered during lease operations shall be borne by the surface managing agency unless otherwise specified by the Authorized Officer of the BLM or of the surface managing agency, if different.

(5) All cultural resources shall remain under the jurisdiction of the United States until ownership is determined under applicable law.

- **PALEONTOLOGICAL RESOURCES**

If a paleontological resource, either large and conspicuous, and/or of significant scientific value is discovered during construction, the find will be reported to the Authorized Officer immediately. Construction will be suspended within 250 feet of said find. An evaluation of the paleontological discovery will be made by a BLM approved professional paleontologist within five working days, weather permitting, to determine the appropriate action(s) to prevent the potential loss of any significant paleontological value. Operations within 250 feet of such discovery will not be resumed until written authorization to proceed is issued by the Authorized Officer. The lessee will bear the cost of any required paleontological appraisals, surface collection of fossils, or salvage of any large conspicuous fossils of significant interest discovered during the operation.

- **OIL AND GAS RESOURCES**

Coal mining operations conducted on leases issued within producing oil and gas fields shall not interfere with the economic recovery of oil and gas, except as determined by BLM. The rights granted in this lease may be subject to prior existing rights of oil and gas leases encumbering all or part of the same acreage. BLM retains and may invoke authority to alter or modify as it deems appropriate and necessary, coal operations on the lands covered by this lease to avoid interference with these prior existing rights.

The following mitigation is specifically directed toward conditions found on and near the proposed Rocky Butte permit area and described in Chapter 3.0 of this EIS.

Topography

Impacts to topography caused by mining can be mitigated by proper design of the postmining surface. The design of the postmining topography (PMT) will be reviewed by Wyoming DEQ/LQD during the permit application process. Specific recommendations pertinent to the Rocky Butte Mine include providing topographic diversity in landforms and hillslopes, stable channels having natural-appearing meanders and pools, and rockpiles and shrub mosaics designed and located so as to give a natural appearance and provide wildlife habitat and cover. The PMT design will be required to approximate original contours which, as generally agreed, means that the shape of the land after mining should be about the same as before, though not necessarily at the same elevation (Martin, et al., 1988, p. 118).

Soils

Impacts to soils can be mitigated by proper identification and handling of topsoils, protection of stockpiled and replaced soils from erosion hazards, and revegetating replaced soils as rapidly as possible. Nutrients lost during handling or stockpiling can be replaced. A properly designed and implemented erosion control, reclamation and revegetation program can ensure successful erosion control and restoration of all land disturbance. Salvage of soils otherwise unsuitable for reclamation due to heavy texture or high salinity may be acceptable for use in special reclamation practices such as restoration of wetlands or playas.

To the extent practical, heavy equipment traffic should be minimized on soils during removal from native surfaces and replacement on reclaimed surfaces, especially when soils are moist, to avoid compaction and destruction of aggregation. Localized areas that become compacted during soil replacement should be ripped to loosen the soil.

Vegetation

Continued emphasis on increasing vegetal species diversity on reclaimed lands, and particularly on establishing shrublands, will help restore wildlife habitat on reclaimed lands. Playas, which rely on topography, soil types and vegetation, provide special habitats that should be restored in the PMT. Continued sampling, monitoring and grazing demonstration studies such as those proposed at the adjacent mines will provide valuable data for continuing improvements in revegetation practices.

Disturbance to vegetation should be minimized in areas adjacent to construction and mining. Reclamation and revegetation measures should be employed to establish diverse, productive, and ecologically sustainable plant communities that are comparable with postmining land uses and adjacent lands. Some important features of the reclamation plan are as follows:

- topsoil salvage and replacement;
- surface grading and contouring;
- seedbed preparation;
- soil erosion control, including establishment of temporary and permanent vegetation;
- establishment of permanent, self-regenerating, and diverse plant communities;
- restoration of agricultural productivity and wildlife habitat;
- post-reclamation monitoring; and
- evaluation and attainment of reclamation success.

If any T & E or sensitive plant species are discovered during construction or coal production, occupied area(s) and similar habitats will be avoided until proper authorities determine that populations can be transplanted (or that other appropriate mitigation can be taken). Additionally, a thorough survey of similar habitats will be made.

Water Resources

Impacts to ground-water quality can be mitigated by special handling of chemically undesirable overburden material to assure that these materials are not placed so as to adversely affect water quality. All mine permit applications submitted to Wyoming DEQ/LQD must include baseline data on overburden geochemistry and special handling plans for unsuitable material to comply with state and federal surface mining regulations.

Provision of ponds and reservoirs on the reclaimed surface helps conserve surface water resources and provides a recharge source for the spoil aquifer. All mine permits require that water uses which are interrupted by mining be mitigated by replacement with water from an alternative source of equivalent quality and quantity. Typically wells which go out of production due to mine-related drawdowns are replaced with deeper wells completed in a sub-coal formation. NWR, like all mine permit applicants, will be required to place a commitment in the Rocky Butte Mine PAP to replace the wells that will be mined through and adjust the pump setting or type of pump in the wells that are expected to be subject to drawdown. The permit documents will also contain the required commitment that NWR will "...replace the water supply of an owner of interest in real property who obtains all or part of his supply of water for domestic, agricultural, industrial, or other legitimate use from an underground or surface source where the supply has been affected by contamination, diminution or interruption proximately resulting from the surface coal mine operation" (W.S.35-11-415(b)(xii)).

Special care must be taken to provide stable channels in the reclaimed surface. The design of stable drainage basins is critical to the success of the overall reclamation plan, and this issue receives considerable attention during the permitting process. In the case of the Rocky Butte Mine, this may require coordination between NWR and The Carter Mining Company, which will mine through and reclaim portions of Tisdale and North Tisdale Creeks and Gold Mine Draw.

Alluvial Valley Floors

Based on the discussion in Chapter 3.0 it is not anticipated that AVFs will be an important issue at the Rocky Butte Mine.

Fish and Wildlife

Wildlife impacts can be mitigated by continuing to consider wildlife habitat in the reclamation planning. Topographic features such as rockpiles and playas, riparian features such as channel potholes and impoundments, and revegetation features designed for wildlife, such as shrublands and trees where conditions permit, will all help to restore and enhance wildlife habitat on reclaimed land. Continued monitoring will provide important feedback concerning the effectiveness of these measures and, hence, important data for future designs. Mitigation efforts should continue to include relocation of affected raptor nests and consideration of raptor nest sites in reclamation planning.

- Subject to landowner preferences and agreements with NWR, all mitigation identified in

this document should be adhered to on both state and private lands.

- Impacts to habitats of high wildlife value (e.g., rim rock, riparian areas) should be minimized both on and off the project area, where possible.

- Speed limits on the project area should be consistent with safe operating conditions, and limits should be strictly enforced; speed limit signs would be posted at advantageous locations along all roads on the project area.

- Where possible, raptor nest sites should be avoided during the nesting season. If the area must be impacted, project activities should occur outside the nesting season. Raptor nests on the project area and within the two-mile buffer should be monitored annually, and if potential conflicts arise, appropriate raptor mitigations should be employed. Raptor mitigation and monitoring plans will be developed in coordination with USFWS, WGFD, and BLM.

- To mitigate impacts to raptors resulting from electrocution and collision with powerlines, measures identified in Olendorff et al. (1981) should be employed as directed by the USFWS, WGFD, and BLM.

- Prior to disturbance, the entire project area and two-mile buffer should be surveyed during early April to determine whether active sage grouse leks are present. Disturbance within active leks will be curtailed during the breeding season, and disturbance within a 2-mile area surrounding each lek will be curtailed where possible during all years leks are active. Reclamation activities providing appropriate breeding, nesting, and rearing habitat would be provided on areas within a 2-mile radius of active lek centers, where possible. These activities include providing:

    - open areas (0.25-0.50 acre) surrounded by sagebrush available for strutting,
    - areas with sagebrush canopy coverage of 20-40 percent and heights 7-31 inches for nesting, and;
    - rearing areas with sagebrush coverage of approximately 14 percent and heights of 9-15 inches (Proctor et al. 1983).

- Prior to land disturbance in any given year, areas slated for impact during that year should be surveyed for T or E species, MBHFI, and State sensitive/priority species. If T or E, MBHFI, or State sensitive/priority species are found on the area, species-specific mitigations may be used as directed by the USFWS, WGFD, and/or BLM.

- Rock piles (coarse rocks > 2.5 ft in diameter) approximately 12 ft (L) X 15 ft (W) X 6 ft (H) should be placed at various strategic locations (e.g., lee slopes near ridges for raptor perches, bottom lands for small mammals [Proctor et al. 1983]) on reclaimed areas (see Appendix B).

- Wetlands, ponds, and other riparian areas disturbed during project implementation should be replaced on a one for one basis as appropriate for aquatic and waterfowl species occurring on the project area; trees occurring in these areas should also be replaced at a minimum of one for one (see Appendix B).

Archaeological Resources

NRHP eligible archaeological resources which cannot be avoided by the proposed action must be subjected to data recovery. Mitigation by data recovery of NRHP eligible sites listed under Criterion D will result in no adverse effect to those cultural resources, as defined under the Section 106 process.

Historical Resources

NRHP eligible historical resources which cannot be avoided by the proposed action must be subjected to mitigation. Mitigation of adverse effects may include historical research and documentation, as well as photographic documentation of historic structural remains to the standards of the Historic American Buildings Survey.

Paleontological Resources

Mine personnel should be instructed to observe for and recognize vertebrate fossils and large, well-preserved petrified tree trunks which might be uncovered during mining excavations. If such finds are made, a qualified paleontologist should be contacted immediately to evaluate the find(s). Excavation in the immediate vicinity of the fossil discovery should be halted until the paleontological evaluation can be made.

Visual Resources

No specific mitigation is recommended for visual resources. Land reclamation and removal of structures, as discussed in the project description, would result in the area returning to its premining status of a Visual Resource Management Class IV.

Noise

Options to mitigate noise impacts are limited. Tree lines and hedges can be effective noise filters but take years to establish in this climatic zone. The measures should be applied only where the duration of impacts will be five years or more. Most of the residences subject to noise impact will only be impacted for a relatively short time when mining activities are occurring nearby (i.e., 1 or 2 years). For short-term impacts, proper placement of stockpiles can deflect or absorb noise and help mitigate impacts. Timing can be planned for the noisiest activities (e.g., blasting) so these activities are as unobtrusive to nearby residents as possible.

Land Use

During reclamation, all pre-mining land uses except residential land would be restored unless otherwise requested by landowners (Appendix B). Reclamation will commence as soon as it is practical during the life of mine, thereby reducing the amount of time that a particular land use is impacted. Cropland would be restored to current or higher productivity levels within one year after backfilling mining pits. Pasture and rangeland would be relatively productive within two to five years after backfilling (Cook et al., 1984). Wildlife habitat would be restored with the establishment of diverse and self-regenerating plant communities, water resources, trees, and specialized topographic features (see above and Appendix B). Landscape diversification by natural processes may take a few decades after reclamation, but reclamation practices will provide wildlife habitat within two to five years after backfilling.

No residential areas will be reestablished during reclamation. Because there would be negligible impacts to oil and gas production, public utilities, pipelines, water lines, telephone lines, and roads, no mitigation would be necessary.

Socioeconomics

Socioeconomic impact mitigation for the proposed mine would be developed in conjunction with local governments on a mutually agreeable basis. The lessee should encourage construction contractors and others to obtain Campbell County sales and use tax permits to increase local sales tax revenues. In addition, efforts should be made to hire locally and purchase from local businesses. The company should keep local government entities well informed of the project so that appropriate planning can occur.

Recreation

To limit impacts to hunting and wildlife observation, wildlife habitat should be reclaimed to approximate premining conditions (Appendix B). Hunting could potentially be permitted on areas where it would not present hazards to mine personnel and on sites far enough from mining operations to ensure hunter safety.

BLM Library
Denver Federal Center
Bldg. 85, OC-521
P.O. Box 25047
Denver, CO 80225